THE BOY WITH THE U.S. AVIATORS

FRANCIS ROLT-WHEELER

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THE BOY WITH THE U. S. AVIATORS

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PREFACE

AVIATION in the United States has entered upon a new phase. The day of experiment is over, though all exploration is not yet done. It is unnecessary to repeat that America taught the world to fly, and was the first to cross the Atlantic and the Pacific. An American plane and aviator was the first to fly to the North Pole, another the first to fly across the Polar Sea.

The task of air-work, now, is to bring into constant and practical usefulness the great flight-principles established by the pioneers like the Wright Brothers and the great fliers like Lindbergh, Chamberlin, Byrd, Wilkins, Hegenberger, and many others. The airplane is to be brought to the service of the American public.

To set forth what flying really is, to-day; to show the various and manifold aspects in which it has interwoven itself into the service of the U. S. Government and the life of the people; to portray — in a measure — the amazing growth of the industry and

the stable and sure performance of American aircraft engines and American-built planes; and to give an added impetus to the urge of American youth to become highly-trained and experienced fliers, is the aim and purpose of

THE AUTHOR.

FOREWORD

In order to give reading interest to a book of this special nature, it is necessary to make use of spectacular doings and hairbreadth escapes in the air. These must not be regarded as typical of aircraft operations. However frequent such events have been in the experimental period of the past, they are so no longer. Commercial aviation in recent years has shown a smaller proportion of accidents per passenger carried than is shown either by the railroads or by automobiles. Aviation in the United States is not becoming safe; it has become safe.

It is difficult to give credit to the large aviation literature which has been consulted, but special acknowledgment is made to books by Col. Charles A. Lindbergh, Commander Richard E. Byrd, Capt. George H. Wilkins, Mr. Clarence F. Chamberlin, Mr. Lincoln Ellsworth, and Mr. Lowell Thomas. Further, thanks are extended to the officials of the

U. S. Army, U. S. Navy, U. S. Post Office Department, and the U. S. Forest Service for information and photographs; also to "U. S. Air Services" and "Aero Digest" for many courtesies extended.

F. R.-W.

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The Boy with the U. S. Aviators

THE BOY WITH THE U. S. AVIATORS

CHAPTER I

A PARACHUTE DROP

"JUMP, Orvie! Backwards. As far out as you can!"

The flames rolled out over the instrument-board of the little two-seater airplane, flying at a hundred miles an hour and over 2000 feet up.

"But you, Father — "

"Jump!"

The engine being throttled off and the intake closed, the order could be heard, clear and incisive.

Accustomed to obedience, as an Army officer's son must be, Orvie Lee unbuckled the strap, climbed to the edge of the cockpit, balanced himself there a moment in hesitation, then threw himself backwards in the air, trying to remember the frequent instructions which he had received concerning the management of a parachute.

Out, and down!

He was in the air, falling, falling!

The plane banked to clear him, following the slight sidewise motion of the control stick with that swiftness characteristic of a modern well-balanced aircraft, inherently stable.

"One!" The boy counted the seconds aloud.

The impetus received from the plane, flying at twice the speed of a fast express, carried him along for a fraction of a second, almost parallel to it. The boy could see his father begin to rise from his seat in the cockpit, shielding his face from the flames.

"Two!"

The pull of gravity seized the boy, and, with a startling suddenness in the change of angle, he began to drop. Instantly there rushed into his mind the ever-repeated admonition:

"Don't freeze your grip to the check-ring!"

He was falling on his back, head slightly downwards.

The rush of air was bewildering, almost stupefying, and the sudden silence, after the steady roar of the airplane's engine, sent a dull roaring through his ears.

He was falling, swiftly falling!

Often he had been told not to worry, when falling, if ever he should have to take to a parachute, for one

does not fall any faster at the end of a drop than in the middle of it. Air resistance to a falling body increases in proportion to the square of the speed, and a man of normal size and weight attains his maximum velocity in about twelve seconds when dropping from a height.

Right now, though, he was falling faster, ever faster, for the maximum velocity of fall had not yet been reached.

"Three!"

He was dropping at a speed of not less than a hundred feet per second, and, if anything should fail to work in his parachute, twenty seconds or less would bring him crashing to the ground.

He did not think of the crash. He had not thought along so far.

But a sudden alarm seized him lest the parachute should not have been properly folded, or lest the slip-ring should not work. He knew that such a thing had not happened in years, for a modern standard parachute is almost infallible in its opening, but the fear flashed through his mind, just the same.

"Four!"

More than the required three seconds having elapsed since he leapt from the plane, the boy pulled the check-string.

Down, and down, and down!

Nothing happened. Was the parachute going to fail him?

His momentum increased.

Orvie's dull fear flashed into an acute and agonized terror.

So swiftly did the panic increase that the seconds seemed to split into fractions, each a full minute long. But he gritted his teeth and tried to keep the counting even.

"Five!"

He had dropped over 500 feet, already, and the parachute had not opened.

For the first time he pictured the crash — and death!

The boy had been told that he must allow at least three seconds for the parachute to inflate and open, but this remembrance was little comfort, now.

It was his first jump, and the time of falling was a nightmare that would never end.

He tried to twist his neck sideways to see whether the ground were not coming up to hit him, but, falling as he was, he had no control of his movements.

The helplessness was terrifying. He squirmed and twisted in the air as though this would have some effect.

The inexorable drop continued.

"Six!"

Surely there was something wrong!

A cold perspiration broke out all over him.

He cast an agonized look aloft.

There was a bulge at the top of the parachute, now, making it look like a comet.

Why did it not open?

"Sev — "

At the instant, the risers jerked him into an upright semi-sitting position and the parachute opened suddenly with a "whoosh" and a cannon-like "bang", as the specially-woven Navy silk fabric took the terrific jar of stopping his meteor fall.

Almost instantaneously, Orvie found himself thoroughly supported in the air, in a comfortable clasp, the well-adapted harness of the parachute distributing all his weight evenly and saving his body from any twisted wrench in the shock.

He had fallen over 700 feet in a few seconds, and, at the moment of arrest, had a dropping speed of well over 125 feet a second when the parachute opened. But, as all parachutes are tested to resist a weight of over 200 pounds falling at a speed of 250 feet a second — which no falling human body can ever attain — the boy's weight at that speed of fall was well

within one-half of the resistance power of the parachute.

And what a change in speed! A moment before, he had been falling at over 100 feet a second, now, under the white spread of the giant parachute, he was floating by comparison, his dropping speed being not greater than 15 or 16 feet a second, perhaps even less, for Orvie was but a light weight.

A couple of hundred feet lower, however, the parachute began to rock with great swings, oscillating from side to side, largely because his weight was considerably under that to which the air resistance had been proportioned. The boy had been taught how to overcome this, by pulling the ropes on one side and thus side-slipping the parachute, but, very wisely, having had no experience in such a feat, he decided to let the ropes alone. The great silk bag overhead was capable of supporting twice his weight, and wind made no difference with it, since the parachute was swept quietly along with the breeze.

Overhead, and shooting swiftly to the left, he could see the plane which he had left but a few seconds before, blazing in the sky and leaving a trail of smoke behind her. With the engine shut off, she was nose-heavy, but the absence of the weight of passengers partly counteracted this, setting the plane on a

slope only a little lower than even keel, gliding downwards as though to make a landing.

To the right, Orvie thought he saw a black speck against the sky. This might be his father falling sheer, the parachute not yet opened.

Then a sudden tiny flick of orange above the black speck showed the boy that the distant parachute had opened safely, and had caught the reflection of the setting sun.

"Dad's all right!" he said aloud, with a breath of relief.

The swing of his own parachute was a bit disturbing, though, in his sudden revulsion from fear to security, Orvie had no dread that it would spill.

A little lower down, the parachute must have come into a stronger wind or air current, for the oscillations first diminished and then almost stopped. It was easier so.

After the bewildering and giddy rapidity of a drop through the air, the greatly reduced speed of descent with a parachute seems like loafing down or even floating, though, in reality, it is not anything of the kind. Even at the normal rate of 17 feet drop a second, that comes to just over 1000 feet a minute, equal to a fall from the roof of a three-story house while one can count steadily: "One — Two!"

Suddenly Orvie realized that he must begin to think about landing. Since the parachute had opened, he was not going to be killed, that was certain, but landing from a parachute drop has its dangers, just the same.

Suppose he should drop over a town! Then it might well happen that he would land on the roof of a house, the parachute might collapse, and he would roll off that roof with almost as fatal results as though he had not come down harmlessly from 2000 feet up.

A glance below reassured the boy. He was not over any town or village. Below were fields, but they were dotted here and there with trees. And trees, he knew, might bring him a nasty fall.

By the speed with which the parachute seemed to be passing over the ground, the boy realized that there must be quite a strong breeze, though, travelling with the wind, it was impossible for him to feel it. He had ground-speed, but not air-speed. Moreover, he was heading straight for a small wood, though, below, the ground was clear.

This was the time to side-slip the parachute, but Orvie was not confident enough to know when to reverse the motion, and, if he side-slipped too far, he would come to the ground with force enough to break

a leg. No, he would let side-slipping alone and trust to luck.

He remembered the old saying current at Kelly Field, the army air-training-ground, which his father had often quoted to him in fun:

"Providence protects aviators and fools; a cadet, therefore, has a double chance."

Still, the trees were a dangerous hazard. If he were caught in the higher branches, with the strong breeze which evidently was blowing, the parachute would turn sideways and, bellied out by the wind, would yank him violently through the boughs and he might fall some distance, after all.

He was right over the wood, now, and coming down fast!

The boy pulled his legs upwards and gave a little jerk sideways to avoid hitting the tallest of the trees, but plunged through the topmost twigs of one but little lower in height. This drag gave the parachute a sidewise angle which cut its air resistance, though the latter was still strong enough to crash him through the trees at the farther side of the copse. The parachute crumpled in and collapsed. Orvie came down, a good deal harder than he wanted, fair in the middle of a blackberry patch.

But, like Bre'r Rabbit, the briars did him no harm,

for a flying suit is stout enough to resist even barbed wire. The Kelly Field motto about "aviators and beginners" proved true in his case, for the parachute came to earth just clear of the bushes — thus saving it from having the silk fabric torn by briars — and Orvie scrambled out from among the thorns safe and sound, with no other damage than a few scratches on his hands where he had put them over his face.

"I'm a member of the 'Caterpillar Club', now!" he said aloud, in great triumph, the alleged Caterpillar Club consisting of aviators who have saved their lives by parachutes in a compulsory jump. Parachutes must be made of real silk from silkworm cocoons — not alleged "silk" made of chewed-up wood.

Orvie undid the buckles of his parachute harness, overpoweringly glad to find his feet on earth, and looked upwards to see if his father were still in the air. The aviator had jumped from the blazing plane several seconds later than his son, but, being heavier, he had reached the ground while Orvie was disentangling himself from the blackberry briars.

Seeing no one in the air, Orvie jumped to the natural conclusion that his father must have come down on the other side of the little wood.

He folded up his parachute with the greatest care — there is just one way, and no other, to fold a para-

chute, and the saving of life may depend upon its being done that way — put it back into the pack and started round the wood to find his father. He had escaped scot-free; perhaps his father had not been so lucky.

The little clump of trees had looked formidable enough as he was dropping into them, but it was only a small copse. Though he felt a bit dazed by his fall through the sky, Orvie hurried around the wood and reached the other side in less than fifteen minutes.

No one was in sight.

Then his quick eye caught a gleam of white under the still strong light of sunset, and he hurried in that direction as fast as he could, calling:

"Father! Father!"

Presently there came an answering hail:

"Hey, Orvie! Here!"

He dashed up.

"Hurt, Father?" he called, as he came nearer.

"Nothing serious," answered Major Lee, as the boy came to his side. "My hands are a bit burned, and I struck ground just in front of two lopped-off stumps. A gust of wind caught the 'chute, dragged me between them, and twisted my leg a bit."

"But your hands, Father!" cried Orvie, horror-stricken. "They're all scorched!"

"A bit, Son. I couldn't take them off the controls till you were clear."

"But I jumped at once!"

"You thought you did, probably. But you hesitated a good thirty seconds before jumping, though you weren't aware of it. Never mind that, now; they're only skin burns. Help me up, Orvie; I think I can walk all right once I get on my feet."

The boy stooped.

"Easy does it! There!"

Throwing his less injured arm about the boy's shoulders, he got up and hobbled a few yards.

"Perfectly all right! There's nothing broken. Just a sprain. I'll lean up against that stump, there, while you pack my parachute. Do it carefully, Son; there's no hurry."

"But we can repack it later on."

"No!" said his father firmly. "There's only one way to do a thing properly, and that is to do it properly every time. And if you're ever going to be a flyer, learn from the start that there isn't any 'later on' in aviation. Everything must be exact."

The parachute duly folded and packed, Orvie came back to help his father.

"What now, Dad?"

"Get to the nearest road, and let's hope that a car

or a buggy or something comes along. I can hobble along, all right, but I'm not good for a ten-mile walk, and I didn't see any town handy as we came down. The nearest one seemed to be over that way —" he gestured with his head.

"But your hands, Father —"

"Talking about them won't do any good," was the rather gruff answer, and Orvie remembered how his father detested that any one should fuss over him. "I started up the engine again, before leaving her. The thing I was most afraid of was that the blazing plane should come down and chase us, as it did Hutchinson."

"What was that? A plane without any one in it start a chase?"

"Just that! Here, I'll tell you about it as we go along. It was at Wilbur Wright Field. Lieutenant James T. Hutchinson was piloting a test flight of a Huff-Daland bomber — the light pattern — with a fellow named Stanley, if I remember, as observer.

"They were about 8000 feet up when the plane caught fire, the gasoline just spurting out through a break in the line, and the hundred-mile-an-hour wind made by the plane's forward flight bent that flame at right angles on the fliers like a Bunsen burner, such as you've seen used in your chemistry experiments at

school. The metal cowling melted as though it had been made of candle wax, and the whole fuselage leaped into flame. Stanley made a jump to a wing. Hutchinson strained in a last vain effort to stall the engine.

"Waiting only a second to make sure that his flying mate would also have to desert the plane, Stanley jumped. The parachute opened normally. The pilot tried to set the plane controls straight to shoot the craft ahead, but one of the wings was already warped to a queer angle, and this rendered it unmanageable.

"Hutchinson jumped. His parachute operated perfectly, too, and that ought to have been the end of his troubles. It was the beginning of them!

"With the engine still running and one of the wings warped up at an unnatural angle, the plane came to a slight bank and began to do rings around the parachute, keeping exactly at the same proportionate height of drop. The pilot was encircled in a streaming wheel of flame. One would have sworn that there was a demon hand at the controls of the blazing plane.

"Hutchinson admitted afterwards that he felt his hair rise on his scalp. There was something so diabolical in that pursuit by an aerial demon of fire.

Courtesy of Irving Air Chute Co., Inc.

THE PARACHUTE: SAVIOR OF HUMAN LIVES.

K and M Photo.

COMING HOME FROM U. S. NAVY MANEUVERS ON THE PACIFIC OCEAN.

"And the spiral around him drew smaller and smaller! The doom was closing in!

"Hutchinson tried to side-slip his parachute, but this made matters only worse, for it brought him nearer to the orbit of that flaming spiral."

"Father!"

"Yes, it's about the most startling case in the records of the U. S. Army Service. But even that wasn't the worst of it. There were two thousand rounds of machine-gun ammunition in the plane, and these started to crackle, bursting in every direction as the craft of fire whirled around him.

"And bombs! There were six of them on the plane!

"The parachute, drifting with the wind, was now almost on the very orbit of this demon-driven thing, and, at its next circle, the flames licked out and nearly touched the parachute. The next time round — !

"But on the outer edge of the spiral, part of the superstructure dropped, blazing, and the plane side-slipped, but recovered, got to a level keel and commenced to circle anew — fortunately, out of the way of the dropping pilot.

"But another plane came in view, with Lieutenant Bertrandias at the stick. He thought the evolutions of the wheeling plane were unusual, and as he came

nearer he saw that the craft was on fire; certain that some one must be guiding it, he flew close to tell the crew to jump. It seemed impossible to believe that the plane had no one at the controls.

"The demon pilot — this is an absolutely authentic yarn I'm telling you, Orvie — took a look at Bertrandias and went after him, nosing up as though for a loop. Betrandias had to get into a nose dive to escape, and, at that, hadn't many yards to spare.

"The blazing plane — engine still running in some mysterious fashion — stalled at the vertical, came down in a close tail-spin, levelled out, took a slight dip which gave it flying speed, banked, circled, and started on a landing glide. About this time this engine stopped, and the plane came down, wheeled over a field, and prepared for a regular landing, but, at the last moment, dipped too far and struck nose down, bombs and gasoline going up together with a crash and a roar of flame like the first eruptive outbreak of a volcano.

"That might have happened to us, Orvie!"

The boy shivered.

"And Hutchinson?" he queried.

"Both men came down all right. But no one would ever have believed their story if it hadn't been witnessed, both from the ground and from the

air; all who saw it declared that the masterless plane behaved exactly as though some malignant hand were at the controls. It's a classic in the annals of aviation, and the chances are about a million to one against its ever happening again."

"Is this the first time you've ever been on a blazing plane, Father?"

"The first, and, I hope, the last. But it isn't the first time I've taken out membership in the Caterpillar Club. I've had to jump before."

"When, Father? Tell me!"

"Wait till we get to the road, then, and I'll tell you while we're waiting. Though it wasn't anywhere near as startling as what happened to Hutchinson, it was lively enough, too!"

CHAPTER II

AN AERIAL COLLISION

ARRIVED at the road, Major Lee tried to sit on a broken bit of snake-fence, but it was clear that his leg was nastily twisted, and, after a minute or two, Orvie had to help stretch him on the grass.

"Keep your ears open for a car, and your eyes for a light," said his father. "I don't want any one to pass without seeing us. Take my pocket search-light, it's getting dark. If you hear anything on the road, jump out and flash a signal for help."

The boy kept silent, for it was clear that his father's injuries were painful, but, after a few minutes' rest, the Major resumed,

"So you want to hear about my first jump, eh? Well, it'll help to pass the time. It was right near the end of my time at Kelly Field, just a couple of weeks before I got my wings. My buddy and I were on a team practising bombing formation.* "

"What machine, Father?"

* This incident occurred at Kelly Field, Texas, January 18, 1927 to Cadets R. E. Krider and G. T. Shleppy.

"One of the regular ones, a big Martin bomber, with three Liberty engines — you've never seen one of the big ones, Orvie. At Kelly, these formation practices are divided into two periods, at least they were in my time, the pilot and the bomber exchanging places. My buddy piloted the first period, and then we made a landing while the Instructor told us each and severally how many different kinds of a fool we were. As a matter of fact, everything had gone off very smoothly, but that didn't matter. Army way!

"Well, we took off again just before 10 o'clock in the morning, a pretty cold day, too, as I remember it, that is for Texas. I was in the pilot's seat. We were practising seven-ship bombing formation. I started out flying position No. 7 in the formation, which was in the rear. Before long, several of the fellows got out of position — they'd hear about it, afterwards! — and, according to instructions in such cases, I moved up to position No. 3, that is, Orvie, on the left and right behind the leader.

"Martin bombers aren't high fliers, but we were about 2000 feet up, just above the clouds.

"The leader signalled for a left-hand turn, which placed us on the inside of the turn. I started to move over toward the ship next to me, ready to follow

around in the turn, when the leader banked up suddenly and abruptly."

"What did he do that for?" interrupted the boy. "Didn't it put all the formation out?"

"He did it because he had to, I suppose, or because something went wrong. It looked to me as though he had his controls over for a turn, but he must have hit a bump in the air; whatever it was, his controls wouldn't take and he came up suddenly.

"If I went on, we'd crash into him, so I tried to pull up, and, just as I did, I felt a big jolt in the rear. I looked around and saw that the aileron and a portion of the lower left wing were gone.

"Another of the planes — it must have been No. 5, right behind us, was just plunging past us, nose down, and it looked to me as if he had just plunged through our wings. I immediately rolled my aileron controls over to the right and jammed my left motor on, in an endeavor to lift the left wing to a horizontal position in the hope to right her.

"But she wouldn't right, and it was clear that she was going into a spin.

"It was time for my buddy to look after himself, but he looked round and grinned as much as to say that he would stay until I gave the signal. I tapped him on the shoulder and motioned that it was time

to jump. He nodded. I gave him the signal, then. We both started back to the wings, because on a Martin bomber, with her three engines, the farther out you jump, the safer you are. My flying mate climbed out ahead of me, going between the motor and the fuselage on the left-hand side. I climbed out on top of the catwalk, so we would not get in each other's way.

"The plane was falling, now, and spinning faster all the time. My buddy evidently let his parachute drag him off the plane, opening it before he dropped from the wing, for I saw him leave the plane and his 'chute open almost immediately.

"But I was caught!

"In the position the plane was falling, I had nipped my foot in the cross-brace wires of the centre section."

"Father!"

"Yes, Son, that was a pretty narrow squeeze. If I had lost my head, or if the wires had been just a little more entangled, my first jump would have been my last. I thought for a moment I wasn't going to get free and the wind pressure was increasing rapidly. But I jerked my foot out, at last, — how, I haven't the slightest notion, — and got hold of the ring in my 'chute before I turned loose with my

hands. There wasn't any time to be lost! That Martin bomber was going down like one of its own bombs.

"I turned loose my grip and fell over from the right side of the fuselage. I saw the rudder flash over my head."

"Did you drop far, Father?"

"I dropped fast, because you see, Orvie, the big bombing plane was falling already. It wasn't like this last time, when our little *Prairie Lark* was flying on an even keel. You probably noticed that you shot forward parallel to the plane before you actually started to fall, didn't you?"

The boy nodded.

"Well, in this first time I'm telling you about, I didn't. I fell sheer, right from the start. I don't think I'd have minded so much, but, some years before — when parachutes were fairly experimental and parachute-jumping was a circus trick — I had seen an exhibitor killed by a parachute which didn't open, and, for that second in the air, the memory of his fall flashed back into my mind.

"I was a youngster then, Orvie, and air work was ten times more risky than it is to-day. I don't mind saying that I was scared, and it seemed to me that I was dropping at about a mile a second. I was falling

head downwards, too, and could see the ground — and it's always better if you don't. That's why I told you to jump out backwards.

"I hadn't gone far, a couple-of-seconds' drop, say, when I gave the rip-cord a good jerk, and the parachute opened immediately. You see, I was dropping fast. I'd dropped through the clouds, and the ship, falling, too, was lost to sight. I never saw her again.

"My buddy was just a bit lower than I was, and quite close. I waved to him, but he was probably looking groundwards to see where he was going to land. Anyway, he didn't wave back. My 'chute was working perfectly, so I began to pick out my own landing. There was a piece of cultivated ground over toward the edge of the mesquite for which I was heading, and I tried to jerk my 'chute over in that direction, but I didn't make it by near a hundred yards. I did manage to clear the dense shrub, though, and landed safely, facing down-wind. I was dragged about fifteen or twenty yards, no more, and then the 'chute landed against a bush and collapsed enough for me to get up and jump on it to flatten the air out. My buddy had already landed, rather harder than I had, and had sprained his ankle a bit. I hadn't a scratch or a bruise. I'm not so lucky this time."

"Well, Father," the boy commented, "I suppose every flier may have to jump sometime. Didn't Lindbergh have to, twice?"

"Four times," came the answer. "He tells about two of them in his book *We,* which we've got at the house and which I know you've read. But he's actually had to take to a parachute four times. Fortunately for him — and for America — the 'chutes worked perfectly each time.

"The first one was at Kelly Field, when he was training for his wings. He and another combat plane were maneuvering, when a sudden tail-wind gust made one of the planes unmanageable, and both went into collision."

"Another collision case! Did both the cadet pilots have to jump?" queried Orvie.

"Both, and both came to the ground without a hitch. The service parachute had been brought almost to perfection only a short time before.

"Lindbergh's second drop was when he was testing a private plane — at Lambert Field, St. Louis, if I remember rightly. Something went wrong with the plane, nobody ever knew just what it was, and at 3000 feet, it suddenly went into a left-hand spin. Nine times out of ten a good flier can recover from this, but the machine wasn't acting to her con-

trols, though Lindy stuck to her until within 300 feet before he jumped."

"Wasn't that too low to risk a jump?"

"Much. But if he hadn't risked it, there wouldn't have been anything left of him. As it was, although the parachute opened immediately, he came to ground with force enough to injure his shoulder pretty badly.

"The third time was on a night flight, taking off from Peoria. A thick ground fog came up, with a ceiling as low as 600 feet, too low for safety. As for flying above it, what was the use? Lindy would only have had to fly until the fuel was exhausted and then come down, anyway. He could see no lights. He tried to get back to Peoria Field, but could see no break in the fog. Then he tried to get to the Maywood Field at Chicago, but the fog held thick and heavy. His fuel tank ran dry and he cut into the reserve. But though he flew in every direction to try to find some hole in the fog, there was none. Flying lower, with only a few minutes of fuel left, he saw the glow of a town dimly through the fog. Knowing, then, that if he landed a couple of miles away he would not risk the lives of those below by having the plane crash on busy streets, he ran up to five thousand feet and jumped.

"You ought to read his story, Orvie, telling how the falling plane, spiraling down, seemed to chase him, something as it did Hutchinson; but it wasn't on fire, of course. He landed in a cornfield, absolutely unhurt, and, after a long hunt in the fog, found the crashed plane 'all wound into a ball-like mass', as he puts it, but with the mail uninjured. You see, Orvie, here was a case where there was nothing on earth wrong with the plane. The smash was purely due to inability to make any landing at all in a heavy fog."

"Couldn't he have made a landing and chanced it?"

"If he had," explained his father, "he would have risked killing others, he would probably have been killed himself, and he wouldn't have saved the plane, either. As it was, he hurt no one, saved his own life, and didn't lose the mails.

"The fourth jump was also a night flight with the air mails. This time it was snow, and not fog, which stopped him. He had taken off from his Springfield stop, but, very soon after, the clouds lowered until the ceiling was less than 400 feet. A light snow started to fall, and Lindy had to travel close to ground to see any lights at all. He managed to locate Peoria, but the snow now fell heavier and began

to swirl; circle as much as he might above the field, there was no chance of making a landing. As before, he made for Chicago, climbing to get up out of the snow. At two thousand feet, the black snow-cloud still held. He tried, once, to descend and make a chance landing, but the parachute flare which he dropped was instantly lost in the driving snowstorm. He banked steeply to follow it — almost too steeply, and barely recovered himself from a side-slip close to ground. About one second's delay in decision would have been death, but Lindy saved himself — he never knew by how close a margin, a few feet, at most.

"Was that snow never going to stop? Was the whole world in snow? He climbed up to 14,000 feet — that's pretty high, Orvie — but the snow was as blinding there as on the ground nearly three miles below. He judged that he was not near any town, set his plane to a level glide, climbed over the cockpit and threw himself off at thirteen thousand feet. In spite of his flying suit, he nearly froze on the way down, but landed safe and sound on a barbed wire fence, which helped to break his fall.

"But I want you to notice, Orvie, that each and every one of these was due to a risk which wouldn't be taken in ordinary passenger aviation. One was maneuvering with combat planes as though in battle,

one was testing an untried plane, and the other two were night flights in foggy and snowy weather. The parachute will always be useful in such kinds of risky flying, but, aside from that, the time has come when an airplane passenger thinks no more about his parachute than a passenger on an ocean liner bothers where the life-belts are kept."

"Yes," said the boy dubiously, "but on some of the big liners they have regular life-belt and boat drill. And I've often wondered, Father; why weren't parachutes used in the War?"

The Major looked grave.

"You touch on a very serious question, there," he said. "The Germans used them, and more than a score of their pilots saved their lives. The Allies didn't use them at all."

"But they'd been invented, hadn't they?"

"Yes, they were in regular use on balloons. As for the value of parachutes from airplanes in war — I'm not sure. It would depend a good deal on what was regarded as 'sporting', by fighting etiquette. Suppose an enemy plane were shot down — by being put on fire, for instance — and the pilot took to a parachute, ought the victorious pilot to turn his machine gun on the helpless enemy or not?"

"Certainly not!" burst out Orvie.

"But there's no way of taking a parachute-dropper a prisoner, if he's falling within his own lines, and if he escapes, that's like giving the enemy another aviator — and first-class fliers in the World War were a valuable military asset. How about it, Orvie? After all, when he's in his plane you're doing your best to shoot him, and he's doing his best to shoot you."

"Yes, but that's different," the boy insisted. "He's got a sporting chance. More than that, it's a fair duel, and that's a part of war. But to shoot him when he's falling, and can't hit back! What would you do, Father?"

"I'd let him go free, I think," said the Major slowly, "then report to my squadron commander. It would mean court martial, I suppose, and I haven't the faintest idea what the decision would be. In the next war — and may that be a long way off! — it is a point which will have to be decided. If one side starts to shoot parachute-droppers, the other will have to do the same in reprisal. That's what always happens.

"But — " and Major Lee grew grave, "where I have always felt that there was a neglect of the use of parachutes was on the training-fields for pilots when the United States first entered the war. In one

of Byrd's books there's a chapter called 'On the Thin Edge of Eternity', which makes grim and pitiful reading; he tells of the daily crashes, 'two or three a day, sometimes', at the Naval Training Station at Pensacola.

" 'One such accident,' he writes, 'I remember with peculiar vividness. Several planes were over the station one morning working out the beginnings of air maneuvers, then in their infancy. The planes were flying in formation: that is, close together and turning together on signal . . . They were turning and twisting with a neatness and accuracy that drew the attention of nearly every one on the station. Suddenly those of us on the ground saw a breath-taking sight. One of the planes used a hair too much rudder on the turn. It side-slipped and skidded into another machine. Instantly the pair locked and fell. As parachutes were not used, then, there was never a chance for the fliers.' Nothing can be much worse than a collision in the air."

"It seems to me — " Orvie began, then jumped up as the drone of an approaching motor was heard. "I'm glad we had our parachutes!" he added, as he went to flash and stop the coming car.

"Yes, a 'chute is something you don't want till you want it, and then you want it mighty badly."

The car came to a sudden stop.

"What's the trouble?" boomed a voice in the dark.

"We've just had to take a parachute drop from a blazing airplane, sir," said the boy, "and my father — Major Lee — is hurt."

"Badly?"

"No," came the Major's strong voice, "leg twisted a bit. Come and help me up, Orvie."

The owner of the car jumped out.

"Sho' ! That's too bad." He helped Major Lee into the car, and began regaling them with all the parachute accidents he had ever heard or read about. As he knew nothing whatever about flying, some of his descriptions nearly made Orvie laugh outright, and he was glad that darkness covered his smiles.

Presently this wore on the aviator's nerves, and he tried to give the subject a less tragic turn.

"Parachute-jumping has its humors, too," he said. "Chamberlin — the chap who flew from New York to Germany, told me his experiences with a negro parachute-jumper and aviator, 'The Ace of Spades'. Chamberlin had plenty of fun with that blackbird.

"One time, Chamberlin took him up, and just when the parachute bellied out in full spread, ready to pick him off the wing, the darky got a full-size scare and wrapped his arms and legs around the strut which he

ought to have let go. The jerk broke the strut, crippled the plane, and it was only by superb piloting that Chamberlin got her to the ground at all.

"The next time, 'The Ace of Spades' advertised that he was going to drop into a vacant lot in Harlem, New York, but he miscalculated the wind and came down on the roof of a department store. A near-riot followed, for there were thousands of negroes looking on and the police reserves were called out to restore order. There was a clear case against him, but sentence was suspended and he was placed on probation for six months.

" 'Two or three days before this period of good behavior had elapsed,' writes Chamberlin, 'he got me to take him over Harlem for another jump. This time he came down neither on a building nor in the street, his parachute catching on the cornice of a three-story or four-story building, so that he was left dangling in mid-air.

" 'The inevitable mob assembled, but the parachute jumper didn't know whether to be more pleased by their plaudits or alarmed over his precarious position. His mind was still occupied with this problem when a window opened beside him and two brawny blue-clad arms hauled him inside. The visitor from the skies caught the familiar glint of brass buttons.

"'"Mister,"' he asked, his eyes still wide from his narrow escape, "'"where is I at?"'"

"'"Nigger,"' was the stern answer, "'"you dropped right into the 37th Precinct station-house. That's where you are. And you're under arrest again, too."'"

"'The prisoner heaved a sigh of relief.

"'"Thank Got I'se home!" said he.'"

Orvie laughed aloud, and the car-owner asked:

"Was that the chap who advertised that he was going to fly to Liberia — long before the time of Lindy?"

"The same one. He used to call himself 'The Only African Aviator'. I guess he was, too. I suppose you've heard how that flight ended?"

"No! Did he ever start?"

"Yes, he actually started. One can never tell, he might have got across by a stroke of luck and got the biggest world's record of all for the negro race. What happened was this. 'The Ace of Spades' went all over the country, in the negro section especially, raising funds to buy a plane for this trans-Atlantic flight. The only trouble was that some of his collecting was done by mail, and, since he gave a definite date for the flight — July 4, 1924 — the Post Office Department got after him, thinking that he was just

collecting the money for himself, which, of course, would be defrauding by use of the mails. It put one of the negro agents of the Department of Justice on his track. Chamberlin tells how the darky detective put it to the darky aviator.

" ' "Nigger" ', he said impressively and ominously to the blustering aviator, ' "you has got a maybe airplane to show for all your talk, I admits, but you has likewise advertised widely and permiscuously to a susceptible world that you is gwine t' fly t' Liberia on the Fourth of July. Does you fly t' Liberia on that day an' date, I an' you won't quarrel, but does you fail to fly to Liberia on the Fourth of July, you flies to Atlanta Penitentiary for twenty years." ' "

"I've heard of forced landings," put in Orvie. "That was what you might call a forced flight."

"It was. But 'The Ace of Spades' was more than half-way in earnest. The pointed words of that Department of Justice agent supplied the other half. The negro had planned to go via Atlantic City, Cuba, South America, and St. Paul's Rocks, to Liberia. Chamberlin had sold him a re-conditioned Boeing seaplane with a powerful Isotta-Fraschini 200-horse-power engine.

"The Fourth of July came at last, but there was still some money due, and the builders of the plane

wouldn't let it start. At the last minute, though, and while 'The Ace of Spades' kept a timorous eye on the husky negro detective, two men came forward and offered to make up the balance. But the tide had gone out of the Harlem River and it was necessary to tow the plane to Hell Gate.

"Chamberlin got his motor started for him. It was running as smoothly as could be. With a final handshake of farewell, the darky gave it the gun and was on his way. He got into the air all right and passed out of sight into Flushing Bay. He had started. He was free from the ominous shadow of the postal laws.

"But, once in the air, he thought he knew it all. Wanting to come back to circle over Harlem to show his skill, he made a steep banking turn over Flushing Bay — probably trying to climb at the same time — stalled, side-slipped, did an unexpected cart-wheel and the next thing he knew he was in the water. He was hardly hurt at all — but two minutes in the air and a ducking was a cheap escape from twenty years in the Atlanta Penitentiary. And Liberia is still waiting for its aerial negro emissary from the United States. But, considering what airplanes were in those days, it was a plucky attempt. And that's the story of 'The Ace of Spades'."

CHAPTER III

CALAMITY JACK

"Look here, Orvie, you're not really going to be such a chump as to take up flyin' for a livin'?"

"Why not?"

"Well, get a gravestone ordered, that's all, an' tell the marble-cutter to put on it: 'Died young'."

"I'll order yours first, Jack," came the sharp retort, and put on it: 'Killed by speeding'. With that sport runabout of yours, you're running ten times more chances than I ever shall be. I've never yet seen any one saved from an automobile accident by a parachute. There isn't time. When you turn turtle at seventy miles an hour, it's generally the finish."

Jack tilted his hat back and scratched his head dubiously. He couldn't think of a prompt reply.

"But look at the aviators killed in the World War!" he said at last.

"Just as many of our infantry fellows 'went West' in the trenches. Oh, I know all about you and your war talk, Jack. You grouse about it, and say it ought never to happen again — so it oughtn't; but

I'd take a bet that if some one started to shoot up the Stars and Stripes, 'Calamity Jack' would be one of the first to step on the gas to find the nearest recruiting office."

"Well, in that case, I don't say — "

"Of course you don't," Orvie interrupted, "and, if you did, I shouldn't believe you. 'Grumble and go makes a good sailor', they say, and that's about your size. You'd grumble, but you'd go. And if we ever should have to do anything for Uncle Sam, the two of us, I'd rather be aloft in a snappy little combat plane than tramping through the mud with a forty-pound load on my back."

"Matter of taste," replied his chum. "I'll keep my two feet on the ground."

"In army boots, and a blister as large as a silver dollar on each heel! You're welcome to it. Or maybe you think they'll promote you to general, or marshal, or something of that kind while you're still a rookie. That prancing-horse business is all right in parades, but it simply doesn't exist in modern war."

"Look-a-here, Orvie, you're losin' your bearin's. What can an Air Force do without infantry?"

"Nothing," came the prompt agreement. "Every one knows that. Cavalry and artillery and

air work are only supports to the infantry. But I'd hate to be in a regiment raked by airplanes with no means of defense from the air. Why, Boy, you'd never know what had happened!"

"Air warfare should be barred," grumbled Jack.

"Admitted," was Orvie's cheerful reply. "So should artillery, and rifle fire, and the bayonet, and grenades, and a whole lot of other things. The only thing you're forgetting is that it wouldn't be war. And American troops are for defensive purposes. That's why I'm for the Flying Corps, if there ever should be another war, and for the flying business in times of peace. How'd you like to have your home town bombarded by Zepps?"

Jack tapped his forehead.

"You've got a screw loose, Orvie. Haven't you learned yet that the airship is about the biggest frost on earth?"

"Why?"

"Look how many of them have smashed up! An' it's only a chance when an airship gets anywhere at all."

"Great reasoning!" came the chaffing reply. "Because Magellan got killed in the Philippines and Captain Cook was eaten by cannibals in Hawaii, therefor it's impossible to reach those places by ship!

Which doesn't prevent forty-thousand-ton ocean liners touching there every week. If you can't think up some better argument than that, Jack, you'd better go back to kindergarten."

"Well," snapped back his chum, "answer me this. Is it, or isn't it, true that the airship is the costliest thing to build in the world, considering how easily it can be shot down by incendiary bullets in war, an' considerin' that it can't pay for itself by carryin' freight for a million voyages, because of its low rate of lift?"

"Quite true, Jack, and you've got hold of the right end of the stick. The airship, as at present developed, is an easy prey to airplanes and it's the plaything of the weather into the bargain; you're right, too, in saying that as a freight-carrier any wheezy old locomotive or tramp steamer can beat it hollow. But Fulton's steamboat wouldn't have had much chance against a snappy-sailing buccaneer or private ship, and a few husky mules would have carried as much freight as the *Clermont* did from New York to Albany. 'Lighter-than-air' craft don't interest me much, but it's nonsense to say that, because they're not of much commercial use yet, they never will be. That's the way sailing skippers talked of steam a century ago."

"What has the airship done?" taunted Jack.

"'Tisn't fair to ask me to crack the airship up, when all my interests lie the other way," was Orvie's reply, "but when the U. S. Navy thinks it good enough to spend a few million dollars for a couple of airships of six and a half million cubic feet capacity, I'm willing to allow that the Navy knows a bit more than I do. Airships have shown that they can act as valuable scouts for a fleet, that they can be very awkward customers in bombing operations — ask England about the Zepp raids in the war, they can be flown across the Atlantic, they can go to the North Pole, and they can, and do, carry a hundred passengers at a trip. You get hold of a real 'lighter-than-air' man, Jack, and he'll convince you that the transportation of the future lies in the airship, or he'll talk himself to a whisper trying. He may be right, or he may be wrong — the next twenty years will probably tell — but you can stake your last dollar that it would be a hard thing to convince the Navy and Congress, both, to spend good money on moonshine."

"That sounds reasonable," said his chum.

"And they've certainly got the right of it when they say that the 'lighter-than-air' craft started aviation. There was only hot air in the Mongolfier bal-

loon, but it wasn't the hot air that these calamity boys talk!"

"Oh, balloons!"

"Yes, balloons, too! A dozen of our best American aces wouldn't have lost their lives strafing balloons in the War unless they had been mighty useful to the enemy. That's the way that Arizona Luke went."

"Who was 'Arizona Luke'?"

"One of the crackerjack flyers of the Twenty-Seventh Aero squadron, and it takes a pilot and a writer like Lowell Thomas * to tell about him. He puts it this way, as near as I can remember:

"' 'Twas toward the end of July 1918, that the squadron stationed near Chateau Thierry received a batch of pilots from the American flying-school at Issoudun. Among them was a lad of twenty from Phoenix, Arizona, just out of high school. Another pilot in the same batch was a stolid phlegmatic chap, Fritz Wehrner, and the two were the closest kind of pals.'

"Luke was a good flyer, but he hated formation tactics and nearly got himself into trouble a dozen times by flying off without much regard to orders. That wasn't discipline, but Luke pulled off a few vic-

*"European Skyways," Lowell Thomas, Houghton Mifflin & Co.

tories entirely on his own, and the squadron commander let him alone. But the place to begin the story is where Luke got the balloon-strafing fever.

" 'It was in August. On the extreme right of the American sector were two German observation balloons — those balloons, Jack, my boy, that you're so ready to sneer at! — and these had been doing great damage by directing an enfilading fire against the Yanks. French and American pilots had repeatedly tried to destroy them, but without luck. The two Heinie "sausages" were heavily protected by batteries of anti-aircraft guns and formations of protecting planes.' "

"They had to be backed up by something!" grunted Calamity Jack.

Orvie paid no attention to him, and went on:

" 'Now strafing balloons that were given this sort of protection was a ticklish affair, so much so that the Germans credited their own fliers with two victories for every balloon brought down. Our chaps had already made a reputation at balloon-strafing. But those two particular gas-bags swung mockingly in front of our advancing lines.

" 'Luke asked the squadron commander if he might go after them, and off he went, trailed as usual by his pal, Wehrner. They flew to a great height and

then Luke suddenly dropped out of the cloud and dived straight at the face of the balloon. The attack took the Germans by surprise and he could easily have fired his flaming bullets into the great bag if his gun hadn't jammed. Of course his dive caused every near-by anti-aircraft battery to get going, and up swarmed the protecting planes.

" 'Luke climbed again, the German scouts hot after him.

" 'Wehrner drew a couple of them away, but Luke seemed to pay no attention to the Fokkers. Up and up he circled, and when in position again, he turned her nose down and went into another dive, plunging straight through the hail of shrieking shrapnel from the German Archies. This time his machine-gun did not fail him, the balloon went up in flames and the observer jumped in his parachute. Luke and Wehrner headed for home, followed by the puffs of the Archies. When he eased his little scout on the turf and taxied up to his hangar, the crowd that ran out found the balloon-strafer's plane riddled with bullets.'

"Good work, eh, Jack?"

"But he didn't stop there, did he?"

"Getting interested? Want the rest of the story? Here goes, then:

" 'Two days later, Luke came home with a second scalp.

" 'This time, a formation was sent out to cover his attack. The American planes had scarcely reached the rendezvous in the sky when they were set upon by a formation of Fokkers. The dog-fight began, but, out of the thick of it, Luke dived toward the balloon. A shower of machine-gun bullets, anti-aircraft shells, and flaming "onions" greeted him.

" 'His fast dive missed!

" 'The dog-fight was still on when he regained his altitude.

" 'Just below the swirl of darting planes he flopped over, and plunged once more straight into that aerial maelstrom of anti-aircraft missiles. A vast burst of flame shot up, and the gas-bag dropped in a cloud of smoke. When the wheels of Luke's plane touched the flying-field, the machine fell to pieces. It had been hit in a hundred places — almost shot out from under him.

" 'Borrowing another, that same afternoon he set off again. Once more a formation followed, and again his escort took on a formation of Fokkers. Just as he had done in the morning, Luke slipped away from the dog-fight and made straight for his victim, Wehrner right after him.

" 'Eight more Fokkers, that had just come on the scene, swept down to drive them from the sky. Luke sped right through them, apparently never for a moment taking his eye off the balloon he had spotted. Once more a burst of machine-gun fire, and another German "sausage" was out of commission.

" 'From that time on Luke talked of nothing but balloons. Day and night he planned ways of destroying them. He seemed to have a mania for this strafing game. Hour after hour he experimented with various types of machine-guns and explosive shells. Whenever weather permitted, he would be in the air hunting them down.

" 'September 15, he went out near a village called Boinville. Three other planes followed, in time to arrive above the balloon sixty seconds behind Luke. Gas-bags on the American side of No Man's Land were instructed to keep their eyes on the Boinville "sausage" at exactly five-five in the afternoon.

" 'Right to the dot the American balloon observers saw a Spad winging its way toward the American lines with five Fokkers on its tail and a burning "sausage" lighting up the sky in the background.

" 'Luke landed just over the American trenches. His comrades thought he had crashed, but he had merely come to earth to get his bearings and for in-

formation regarding another enemy balloon. A few minutes later he was high in the air, and before half an hour had passed a second observation bag was in flames.

" 'As usual he returned to his aerodrome with his little Spad riddled with bullets. But a telephone message from headquarters announced that there was still another enemy "sausage" on the horizon. So, in the gathering dusk, he and Wehrner set out, and just at nightfall a great flame lit up the sky.

" 'On the following day, again toward sundown, Luke walked to his plane and called out to several pilots standing by:

" ' "See those 'sausages'?" He pointed out two specks in the distant sky, fully two miles behind the German lines and about four miles apart. "The first one is going up at seven-fifteen, and the second at seven-nineteen."

" 'He and Wehrner took off, and the men around the field stood with their watches in their hands and their eyes fixed on the distant bags.

" ' "There she goes!" exclaimed Major Hartney, the pursuit group commander.

" 'A flare lighted up the horizon. It was exactly seven-fifteen.

" 'By now the second balloon was lost in the dusk,

but eyes were fixed on that part of the horizon where it had been seen a while before. At seven-nineteen there was a yell from the group. A second glare flashed at the point where they had fixed their eyes.' "

"Is this straight goods, Orvie, or are you making it up?"

"From the official records! And that isn't all of it, either:

" 'Two days later, on the 18th, the last half-hour of daylight found the two inseparable airmen above one of the two balloons that the Germans had near each other on the edge of Three-Fingered Lake. No hostile aircraft were in sight. Apparently the enemy thought it too late to worry about attacks from Allied air-men.

" 'Luke went into a dive while Wehrner waited above, watching. It took Luke three dives before he got his victim.

" 'Luke zoomed up to meet Wehrner when he saw a formation of six Fokkers bearing down upon him. Perhaps Wehrner had fired the rocket which was agreed upon as the signal for such an emergency. If he had, Luke, in the midst of all the blazing Archie fire, had failed to see it. At any rate, Wehrner was now patrolling on a line to keep a path of retreat open for Luke.

" 'The German airmen had laid a trap for the two daring "sausage" destroyers, who were now recognized as their two most dangerous antagonists. The Fokkers had lain in waiting, hidden among the clouds, knowing that the two balloons would be bait that would surely draw the birds they were after.

" 'Those six Fokkers were coming from the west — that is, from the opposite side to Germany. They had cut off the direct line of retreat to the American lines. But Wehrner was holding open a line of escape further to the north. The second balloon lay still further to the east.

" 'With characteristic rashness, Luke had made up his mind in a flash to get away by running east, deeper into Germany, taking a few shots at the second "sausage" on the way and then slipping around the Fokkers. The German formation spread out to cut him off. Over balloon number two he made a single perfect nose-dive, and the sky was ablaze with exploding hydrogen.' "

"But I don't understand," said Jack, "why didn't Luke get blown up himself, then?"

"A nose-dive," explained his friend, "means dropping like a stone. Half a second after Luke fired, he'd be a hundred feet or more below the balloon. Of course, the force of the explosion would set the air

into a whirl, but a second more of drop would take Luke to where he could pull back the joy-stick a bit and bring the plane level.

" 'When he zoomed up, Luke saw himself entirely surrounded by German planes, save in the direction of Germany. Three more pursuit ships were closing in on him, making nine in all.

" 'Wehrner, never suspecting that Luke would be so foolish as to attack the second balloon under such circumstances, had kept to his post right to the last. He now could have turned west and slipped off home, leaving Luke to shoot it out with the ring of enemies. But Wehrner was not that sort. Luke saw his pal sail straight into the three oncoming Fokkers, attempting to open a way for the balloon strafer. The three enemy planes directed a converging fire on the lone Spad.

" 'Wehrner's machine fell over on its side. Luke saw a path of fire leap from the gasoline tank.

" 'The Spad went down in flames!

" 'Luke turned upon the three who had sent his pal into his last dive. They were above him, but, crazed with fury, he zoomed straight at them. Picking out one, he disregarded the others and poured a steady stream of bullets into the Fokker. The other two were behind him, and he could see their tracer

bullets streaking by his face. But his one thought was of vengeance, and he kept after the Fokker until it fell in flames.

" 'That was number one, but it was not enough for him.

" 'He made a quick bank and turn and dashed at one of the other two planes that had been behind him. Another fierce burst of fire, and it followed its comrade.

" 'Number two!

" 'The third German pilot turned tail and raced off as fast as he could go.

" 'Still Luke was not satisfied. He hunted around for the other formation of six that had first stalked him. They were darting away in the distance.

" 'But beyond, down to the north of Verdun, were small fleecy white clouds, Archie shells from our own Allied lines. The Allied anti-aircraft shells gave off a cloud of white smoke when they burst; the Germans gave off black.

" 'Luke darted in that direction. He saw five French Spads hurrying to attack an L. V. G. photographing machine, which, probably, had already taken some photos behind the Allied lines which would be of service to the enemy.

" 'The six Fokkers that had been the first to annoy

him, and that indirectly had been the means of the crashing of Wehrner were cutting in ahead of it to cover its retreat. The L. V. G. was just ahead of Luke as he came up. He swung down on it like a rocket, firing both guns. The photographing machine fell into a tail spin and crashed near the old Verdun fiying-field.

" 'Number three!

" 'The six Fokkers turned and headed east.

" 'Frank Luke, the Arizona high-school boy, in the short space of one afternoon, had shot down two balloons, two fighting Fokkers, and one two-seater enemy observation plane, a feat unequalled in the entire annals of the World War. But it gave him no feeling of triumph. Wehrner, his pal, was gone.'

"For a few days he refused to go into the air, and took a week's leave. He had earned it. Then, on September 26, the opening day of the Argonne-Meuse offensive, he was recalled.

" 'He seemed to have his old spirit once more. The next day he shot down a Hanoverian two-seater, and that evening got another balloon. He passed the night and the next day at a French flying-field. In the evening he flew over the American Balloon Headquarters and dropped a weighted note:

"'"Look out for enemy balloons at D-2 and D-4 positions. — LUKE."

"'They watched. A few minutes later, a great glow lit up the sky in the direction of the German lines, and then, quickly, another. The balloon officers telephoned to the aerodrome, reporting Luke's two new victories.

"'That night he did not return, nor the next night. The squadron commander vowed that when he did come back he would recommend him for a court martial and then the Legion of Honor.

"'But they never saw Luke again!'"

"What had happened?" queried Jack.

"No one on the American side knew until after the Armistice. But the people of the little town of Marvaux saw the end. Just after shooting down the two balloons that last night, Luke had suddenly appeared, flying low. It looked like a forced landing. He may have been wounded, or his engine been injured.

"The town was full of German soldiers. He swept over the houses, almost touching them, and opened fire with his machine-gun on a detachment of troops in the village street, killing eleven and wounding many others. Then he swerved and landed in a field not far from a stream. He climbed out and

headed for the stream. It seemed as if he wanted to get water.

"Several German soldiers made for him. He saw them and turned back to his ship to get his automatic. Shots rang out. He fell to the ground beside his plane. When the citizens of Marvaux came to take him to the local cemetery, they found a great wound in his chest. The Air Service built a monument on his grave, after the War. In seventeen days he had shot down eighteen German aeroplanes and balloons, an unequalled record. He died America's Ace of Aces — and little more than a boy, at that!"

CHAPTER IV

RIDING THE STORM

Calamity Jack looked thoughtful. This importance of captive ballons in war had never occurred to him. Like a good many people, he thought ballooning was just a circus performance, or else that it belonged to the Middle Ages.

"I suppose," he said thoughtfully, "that's why they still have those Gordon Bennet Cup races." Then his natural grouch returned. "But they do seem like a fool thing, anyway."

Orvie retorted as he had done before.

"If the big Powers think it worth while to send their best men to contest a race like that, it isn't just for the fun of it. And if you are going to talk about the Gordon Bennet, don't forget that it's the U. S. Army which won the last race and got permanent possession of the trophy for America."

"Was it?"

"It certainly was. Some of these days, Jack, I'm going to get nailed down in your head that the U. S. Army and Navy Aviators are at the top of the tree when it comes to heavier-than-air flying, but it won't

do you any harm to hear how the Army won the last race, in the wildest kind of a storm, and with adventures enough to make a dime-novel thriller. Lieut. W. O. Eareckson * tells the story of that mad flight, himself.

"At exactly 5 p. m. Eastern Standard time, May 30, 1928, a great throbbing sigh, followed by a ringing cheer, went up from the multitudinous assemblage gathered at Bettis Field, Pa., for it was then that, in the words of the programme: 'the first racing balloon leapt into space'.

"Einstein is right, apparently, on this relativity stuff. Everything is relative to something else, and it all depends on the point of view. Thus, quite contrary to the words of the enthusiastic programme scribe, one heavier-than-air Superman was heard to mutter, as this racing balloon soared overhead at the spanking clip of eight miles an hour:

" 'By all the spark plugs, is that thing racing? Hey, buddy, don't come too low! You might get run over by a snail!'

"These two opinions being so diverse, a few words in explanation of a balloon race would be appropriate. As in the case of Aesop's fable of the Tortoise and the Hare, the victory is not always to the speedy. There are other elements to consider.

"Of course, to have any well-founded expectations of winning a race, the team in the balloon must be topnotch in the actual handling of their craft. But, in addition, they should know as much as possible of meteorology, have an intimate knowledge of naviga-

* In "U. S. Air Services", a most useful and excellent Aeronautical magazine.

tion, understand the theory of gases, and possess a good grade of old-fashioned grit. Unexpected things happen on any long free balloon flight, and it is well to be so constituted that you can always expect the worst with a tranquil mind, and be grinning when it happens.

"The winner of a balloon race is the balloon which, when all the contestants have landed, is the farthest from the point of take-off, the distance being measured on the arc of a Great Circle.

"The weather on the day of the race had been cloudy with occasional showers accompanied by some mild thunder and lightning, and it was with a feeling of relief that we saw Old Sol break through the cumulus canopy and smile down about half an hour before the starting of the race. Beginning at five o'clock the balloons took off at five-minute intervals until all fourteen entrants were in the air and heading in a general easterly direction; the lower ones going a bit north of east, the higher ones a bit south of east.

"Our balloon, the *Army Entry No. 1,* being in ninth position, took off at 5.45 p. m., and, flying low, headed up toward New England. We had hardly left the ground when we saw that directly ahead of us and about ten miles distant was a high-piled cumulus cloud form which issued ominous rumblings, flashes of lightning, and, as we found out later, rain, hail, death, and destruction.

"Having been in storms before, we were not dismayed and even decided to stay low in order to save gas, run into the storm to gain speed, and stay with it until night caused it to dissipate.

"We had not long to wait!

"In about forty minutes our speed had picked up from eight miles an hour to twenty, we were directly

under the cloud and starting to rise with the rising convection current which fed the cloud. Wishing to stay low, we valved, but continued to rise even more rapidly as the current became stronger. We reached our pressure height at 1000 feet and continued rising at a rate of from 800 to 2000 feet a minute, spilling gas as we went, until, at about 5000 feet, we began to descend as rapidly as we had climbed.

"And with us came the rain, in gobs and scads, rivulets and small waterfalls, while we whirled, eddied, jostled, and spun in the most violent set of cross currents I have ever encountered, meanwhile being shocked when the lightning sizzled, and jolted when the thunder roared.

"More or less expecting to be struck by lightning, we put on our parachutes when we entered the clouds, and, figuring that if we were, we might be stunned rather than killed, we took this precaution: sitting on the edge of the basket, gripping a rope and leaning outwards with our centres of gravity well out in space, we tied strings from the rip-rings of our parachutes to the basket suspension ropes so that, in case we were struck insensible, we should fall out of the balloon, our parachutes would open, and we should descend in one piece, rather than with the unmanned and probably burning balloon.

"Thus we rose and descended until we left the cloud and saw the earth 1500 feet below. Then we got busy checking the descent of our craft. Alternately we poured sand, bag after bag, until we had poured twelve bags and checked our downward velocity to 800 feet a minute. Then we cut loose our drag rope so that it hung down below us, and waited for the earth to come up and spank us.

"While waiting, I had a chance to look around and

saw balloons all about us, some of them performing the most undignified stunts, and all showing the loss of a third to one-half their gas. North-east, the *Pittsburgher* chased the *Army Entry No. 2* up a valley; north of us, Captain Honeywell sat like a huge stationary mushroom; from above, Van Orman and Morton started down, caught up with and flashed past us in a shower of sand as they cut bag after bag in a vain attempt to check their descent. We watched them strike, and up they came again like a rocket, disappearing in the cloud above.

"Then we hit.

"And how!

"Hardly had we hit than the wind had us in its clutches, racing us over the ground, sometimes at velocities of from 50 to 60 miles an hour, while our static heaviness caused us to kiss Ma Earth every three or four hundred yards. There is nothing on earth more exhilarating than hedge-hopping in a free balloon at a high rate of speed.

"We crashed through trees, fences, telegraph lines, always keeping the balloon statically heavy so we would lag behind the central fury of the storm by our friction over the earth, until, as we sped over a small rise, we found ourselves face to face with the worst menace to free ballooning — a high-tension power line.

"With about 30,000 cubic feet of inflammable hydrogen gas a bare ten feet above our heads; with every stitch of clothing and equipment soaking wet and oozing water; instruments, angel cake, ham sandwiches, and bananas in a sloppy chaos due to our violent bumps and hits against terrestrial obstacles; we sped at the rate of 50 miles an hour directly towards six power lines, each carrying about 50,000

volts of electricity, and so placed that they would strike us just about three feet above the load-ring.

"We knew that the instant any two wires were short-circuited, there would be a spark a yard or two long, and even the smallest spark would ignite the gas, thereby causing all young officers below us in seniority to gain two files on the promotion list.

"What people do at such times is interesting . . . What we actually did was cuss, grab a double handful of wet hemp, and set ourselves for the shock, were it to be dynamic, electrical, or thermal.

"It was none of the three.

"Just then Lady Luck tossed a horseshoe at the seats of each of our soggy trousers, and we went through the power line as through a yarn thread. Allah alone knows why, but there was no spark as we broke all six wires and kept moving toward where a railroad ran in the shade of a twelve-wire telegraph line.

"Comparatively, that telegraph line was as harmless as a black snake beside a rattler. It was less venomous, but it was stronger.

"We hit it, crashed through eight wires, slid along the remaining four till we hit a pole, lifted the pole out of the ground, went on a few yards with the pole firmly wedged between two suspension cables, and came to a halt in a grove of trees on the edge of a stream. 'And there we were ketched' and thrashing around like a tom-cat in a croaker sack.

"But our apparent misfortune was our salvation. The storm we were riding, though violent, was small — typically Napoleonic — and the five minutes we used in extricating ourselves from the spreading arms of the pole's cross-piece was sufficient to allow the

storm to pass on. By the time we were free, the storm had left and was already abating.

"Free of the pole, our next problem was the trees, and, this solved, we yet had to make ourselves statically light enough to float in the air. This was accomplished in a rather unique manner.

"Around our basket we had placed, before the take-off, a rubberized fabric envelope, so that in case we landed in water, our basket would become a boat in which we could float for a time and remain dry. The rain reversed this process by placing the water inside the basket instead of outside, so that there we stood ankle deep in about 400 pounds of water.

"This water had replaced the sand we expended during the storm and gave us a superfluity of ballast, besides. We knew that if we lost all the water, literally the sky would be the limit of our altitude. We must lose some of this superfluity or stay put; but we must not lose it all.

"What we did was this: Very carefully we cut a small slit in the envelope, well over in one corner of the basket. Then we stood over that hole, our weight tilting the basket that way until enough water had drained out to make us sufficiently light to take off. As we started to rise, we walked to the opposite corner, tilting the basket in the other direction. Our theory worked; the hole was above the remaining water which accompanied us as ballast.

"Now that we were satisfied that we could fly, our attention turned to ourselves. Soaked to the skin, our food a total loss, we faced the already lowering night — which bid fair to be rather chilly — without too much enthusiasm.

"The balloon, shedding water a bit faster than the contracting gas (due to increasing cold), lost lift, needed no attention, but continued gradually to rise

and drift slowly in a southeasterly direction. This gave us a chance to take off and wring out our clothing which, being the driest we had, we put back on.

"By this time we were at 5000 feet and our speed to the southeast had increased to fifteen miles an hour.

"But, O Boy! it was cold!Our hands were shrivelled from being wet, our lips were blue, and our teeth chattered like two skeletons with inflammatory rheumatism having chills on a tin roof. At 5200 feet it started to snow, and at 7400 feet, our maximum altitude, ice began to form on the rigging in our drinking water, and on our clothing. But our speed steadily increased until it had reached about thirty miles an hour, and our spirits rose accordingly.

"All through the night, which was alternately moonlit and overcast — depending upon whether we were above or below the clouds — we froze and thawed, freezing as we rose, thawing as we reached the warm stratum of air which extended to about 500 feet above the tree-tops. As the night passed, we entertained each other by recalling experiences during which we had been the hottest.

"The flight continued all through the night. The application of our knowledge of navigation rather lost itself by the wetness of our maps and our more or less natural mental apathy and physical inertia. Besides, when we moved, our bodies found previous untouched areas in our wet clothing, which, due to lack of contact, were surprisingly cold.

"Our navigation, then, consisted in an occasional compass check of our direction, and conjuncture — from our general knowledge of the country — of what town that patch of lights might be, or what river that silver ribbon was.

"And so on unendingly till morning, when, just as

the dawn broke, we drifted out over the Rappahannock River and became sufficiently alarmed to find the least sodden map and accurately check our location.

"Our flight ended, due to the proximity of the Atlantic Ocean and the very commendable hesitancy on our part to dim Lindbergh's glamour by making a trans-Atlantic flight in a free balloon. For these reasons, then, we landed at Weems, Va., rolled and packed our balloon, and the flight of *Army Entry No. 1* was over.

"It was not until we awoke some hours later that we learned about the storm-caused disaster, or that we had won the race by exactly a mile and a half farther than the *Barmen,* the German entry, having made 460.9 miles in that tempestuous night. But our elation at winning was overshadowed by our sorrow at having lost forever the comradeship of two real men, two regular buddies, Evert and Morton, both killed by the storm we had safely passed through."

"We won, anyway!" was Jack's comment. "But I'm surprised the Germans sent a free balloon. I thought they had only built Zeppelins, and none of them since the War. They were all shot down, too."

"Nonsense! Never heard of the *Los Angeles* and the *Dixmude?* They were German Zepps. I won't bother you with the story of the Zepps in the War, because they didn't worry us, much, and the good old U. S. A. is what interests me most.

"The story of the Zeppelins after the War doesn't

take long to tell. After the Armistice, the latest Zepp under construction for the German Navy was the *L–72*. The Zepp Company decided to fly the ship to America, in the hope of holding its big construction company together and starting a post-war trans-Atlantic passenger and commercial service. Don't forget — that was ten years ago. It might have worked, for the *L-72* was as big as the *Los Angeles* and not so heavy. Everything was ready for a flight to New York in April 1919, but the Inter-Allied Commission forbade it. Eight weeks later the British *R-34* flew from England to Mineola, L. I., the first aircraft to make a non-stop trans-Atlantic flight.

"But before we come to the commercial end of it, Jack, take a look at what happened to the Zepps which Germany still had at the end of the war. Early in 1919 the Allies agreed that Germany, as 'a conquered nation in an aggressive war' should surrender her battle fleet. You remember that the Germans did so, and then sunk all their ships in the anchorage off the Scotch coast. It was a prearranged plan."

"Well, in my opinion — " began Jack.

"You haven't any," was Orvie's retort. "Nor have I — we were in the infant class, then. The Germans did it, anyway. Now the Zepps, during

the War, were officially attached to the German Navy. Under the same prearranged plan, the same day that the vessels were sinking at Scapa Flow, the *L-14, 41, 62,* and *65* at the headquarters at Nordholz, and the *L-52* and *56* at Wittmund were destroyed by the simple system of cutting the overhead cable which held them and letting them fall to the ground into a tangled mass of metal. They were not inflated, of course."

"What a shame!"

"It certainly was a heavy loss. But, in reprisal, the Allies demanded that the remaining seven Zeppelins should be surrendered to them, as well as the two new commercial ships, the *Bodensee* and the *Nordstern* which the Germans had built since the end of the war. Let's follow their history a bit.

"The *L–72,* the *LZ–113,* and the *Nordstern* went to France. The *LZ-113* was dismantled. The *L-72* was renamed the *Dixmude,* and the world's record endurance flight was made with her, over the Mediterranean in 1923. A few weeks later, while making another flight, something happened to her up aloft — no one ever knew what or why — and she drifted for days, at one time over the Sahara, at another over the sea. Her end is still a mystery, though the bodies of her captain and a few members of the crew were

washed up on the shore of Sicily. She may have been struck by lightning.

"The Italians got the *L-61* and the *LZ-120*. They didn't last long in Italian hands. The *LZ-120* was ruined during inflation in her hangar. As for the *L-64*, she was smashed up beyond repair in the very first landing that the Italians attempted.

"The British got the *L-64* and the *L-71*. The first of these was dismantled — for experimental purpose, it was said — and the *L-71*, much better handled by the British than their two were by the Italians, was used for flying and hangar tests and for training. She still exists, but is not fit for extended flying. Of course, that's some time ago, and a Zepp's life is never a long one.

The *L-30* went to Belgium, and the *L-37* went in parts to Japan. Belgium, as a neutral country, never flew her ship; Japan used hers for a study of the principles of Zeppelin building. That was the end of the last of the war Zeppelins."

"But where did America come in?"

"She didn't. I'll come to that in a minute. The *Bodensee* proved a good commercial ship — this was ten years ago, I repeat! In the fall of 1919, she made 103 flights in 98 days, twice crossing the Baltic to Stockholm. But, although the *Bodensee* had proved

her daily reliability in Germany, the Italians, having neither trained Zeppelin navigators nor crews, could do nothing with her. The *Nordstern* was almost completed at the end of 1919, but had not left her hangar. The French, who got her after she was completed, left her to rust away; they hadn't trained Zepp crews, either.

"But the U. S. A. was left out in the cold. That wasn't the fault of the Allied Commission, for it had offered America the pick of the Zepps. But there were no hangars big enough for the huge airships in America, the U. S. Government had never taken the trouble to investigate the real war record of the Zepps, and there wasn't thirty cents' worth of public interest in them. In fact, they were popularly disliked. So our representatives declined.

"But, a little later, in 1920, according to the statements of Captain Lehmann — the world's Zepp authority and navigating officer of the *Graf Zeppelin* on her famous 1928 cruise to America — an American Army airship officer went to Germany and arranged by secret contract for the Zeppelin Company to build for America the biggest craft yet. The news leaked out. And, as the United States was still legally at war with Germany, the Government couldn't approve the deal. So we lost that.

"Then Great Britain entered the field and built two giant ships, the *R-37* and *R-38*. When they were nearly completed, however, the British realized that while building an airship is one of the most expensive performances on earth — in proportion to its possible value — running one is scarcely less costly. The British taxpayer was not easy in his mind over this expenditure. The *R-38* was offered to the United States and accepted at a purchase price of fifteen million dollars."

"Whew!" whistled Jack. "They do come high!"

"The *R-38* certainly did," agreed Orvie, "but not in the way you mean. Some of the very best of the airship men in America: Commander Maxfield, and Lieutenant-Commanders Coil, Bieg, and Byrd, went over to take part with the pick of the British officers and men to fly her back. By fluke — or fate — Byrd missed a morning train and so was not aboard the *R-38* — rechristened the *ZR-2* — on her famous trial flight in England.

"That flight was hoodooed from the start. Commander Maxfield was dissatisfied, but, as the ship hadn't been officially turned over, it was not his place to make any remarks until after the trial flight. Coil, who had married an English girl just before, had told her that he was sure there was something wrong

with the ship. He was right. Medical Officer Taylor told Byrd that one of the enlisted men had come to him the day before saying that he dreamed that the ship had exploded over the Humber River.

"Shortly after daylight she took the air, and sailed away majestically. She got off without a hitch. She was to cruise all day and all night and then to hitch to a specially prepared mooring mast.

"The *ZR-2* was about 1200 feet above the Humber River, having successfully completed all her tests for speed, and was being tried out for quick turns when the extreme helm put too great a strain on her longitudinals, she broke her back, and crumpled just abaft the rear engine cars. Fire broke out at once. The explosion came immediately after. The forward end of the ship fell straight down and disappeared under the water; the rear end floated a while, and three men were rescued. Coil was found dead near frame ten, the section which he had told Byrd he thought to be weak. Maitland was found with his hand on the controls. The man who had dreamed of the explosion was dead. Out of the fifty men aboard, five only lived, one of the five an American enlisted man. The biggest tragedy in the history of peace-time aviation!"

"What I told you!" grumbled Calamity Jack.

"Airships haven't had much luck in America," Orvie went on. "The U. S. Army purchased an Italian semi-rigid ship, the *Roma,* but, on her trial flight from Langley Field, Va., she struck a high tension cable when flying low, and she, too, came down in flames. All this, Jack, was in the days when inflammable hydrogen gas was used — we use helium, now. It hasn't as much lift, but it's not nearly so dangerous.

"Now, you remember that the Germans had destroyed seven of their Zeppelins. Whatever may be said about the voluntary sinking of the German fleet, after delivery, it was certain that the Germans had not lived up to the terms of the treaty in destroying these Zepps before delivery. They had to make good. America's share was to be a new Zeppelin built to her orders. It wasn't a very big one. This was the *Los Angeles,* built in Germany, and in 1924 she flew perfectly from Friedrichshafen to Lakehurst, N. J., in 81 hours.

" The *Shenandoah,* however, built in America, was earlier in the air than the *Los Angeles.* She made good, flying from New Jersey to the Pacific Coast and back. In January 1924, while riding at her mooring-mast in Lakehurst, she broke away in a storm and battled the tempest for eight hours, getting

back at last to her mooring-mast when the wind lulled. But this probably strained her.

"Anyhow, two years less than a day from the time that she first took the air, the *Shenandoah* was ordered to St. Louis. She left the mast, glided along safely in fair weather, then struck a storm over Ohio. The squall had tornado force in the upper air, and whirled the huge airship up like a shuttlecock, throwing her to seven thousand feet in one wild rush. There, cross-currents took her. She shook and writhed like a snake in the teeth of a mongoose. A minute of that was enough. The *Shenandoah* began to go to pieces. The control gondola was wrenched off and fell like a bomb, killing Commander Lansdowne and twelve officers and men.

"With a rending scream, the storm just simply tore the ship in two as you might tear an envelope. The nose-part bounded upwards out of sight. The after-part contained most of the rest of the crew, and, by valving the gas, they managed to make a parachute sort of landing, only one man being killed.

"But the nose-part, having no car to give her gravity, pitched and tossed and spun around like a soap-bubble. The men on it scrambled up into the girders and hung on as they could, as often upside down as not, for the nose whirled about like a child's

toy balloon. But the squall passed and this section of the *Shenandoah* came to earth without any further fatality. Fourteen had been killed and one injured out of forty-three. And that was the end of the *Shenandoah.*"

"It doesn't make me any more anxious to start flying!" commented Calamity Jack. "As you tell it, the most horrible things you can think of happen in the air. In a smash-up on land, there you are, but when it is 'way up in the sky, where are you? Solid earth is plenty good enough for me for a while longer."

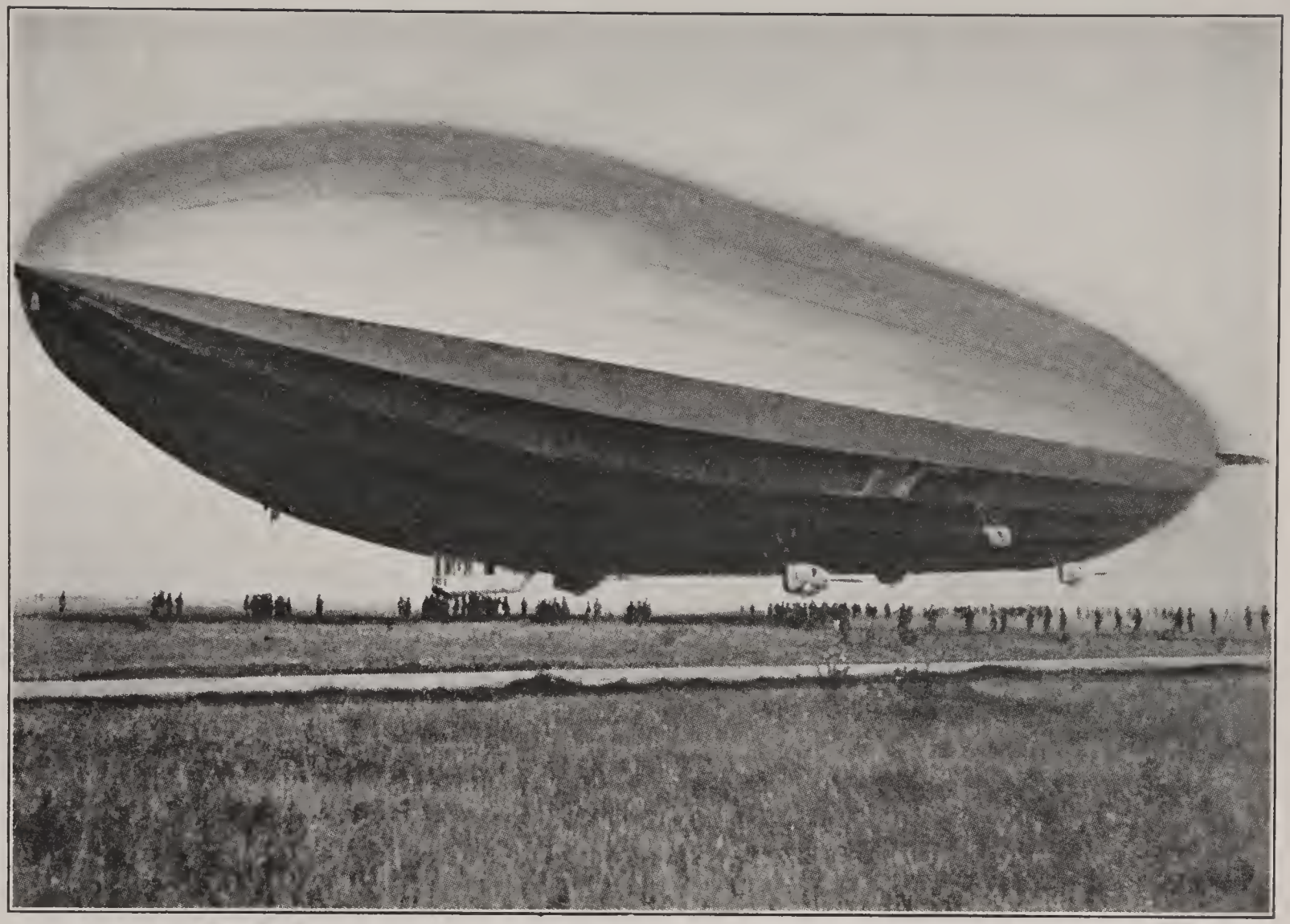
"Perhaps not. But the story doesn't end there. The latest event in airship history is the visit to America of the *LZ-127* or the *Graf Zeppelin,* which, in spite of having struck bad weather on her way across and having injured a side fin, thereby having been forced to take a roundabout course of 6300 miles, flew from Germany in 111 hours, carrying her full crew of forty and a passenger list of twenty — the first crossing of the Atlantic by a passenger-carrying airship. Not only that, but she flew back to Germany successfully.

"And yet, Jack, huge as she is, and successful as was her trip, she's only 3,700,000 cubic feet and will look like a baby beside the two new 6,500,000 monsters of

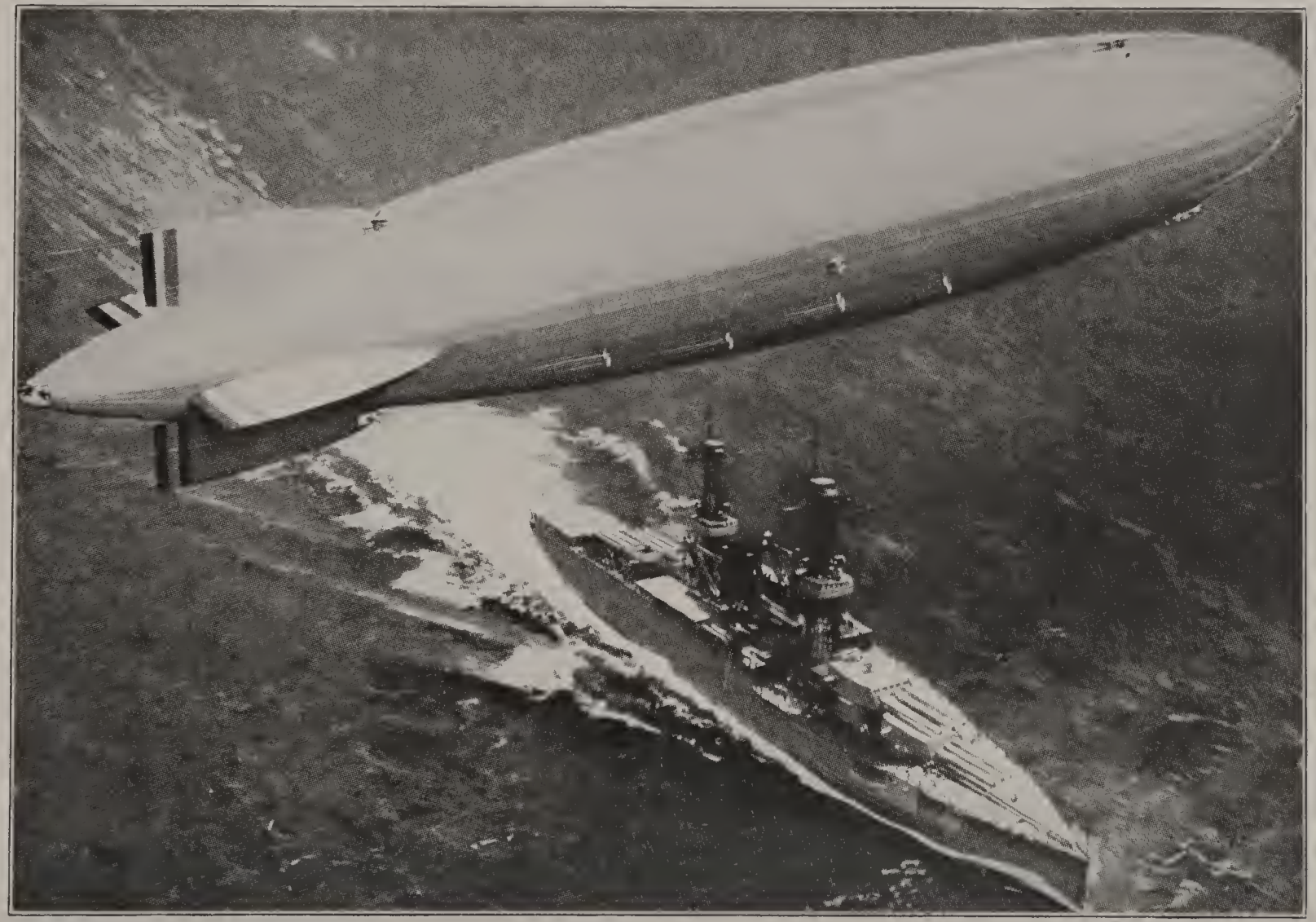
the U. S. Navy. They're to be American-built and American-manned, and I shouldn't be surprised to find the first round-the-world airship record won by a U. S. crew."

"You're dreaming, Orvie!"

"Maybe I am. But I don't see why I shouldn't. We've certainly got a mighty big handful of world's records in the airplane line!"



THE ZR-2, LEAVING THE GROUND FOR THE TRIAL FLIGHT.



Courtesy of U. S. Air Services.

WHAT THE U. S. NAVY HAS IN MIND.

Design for one of the new 6,500,000 cubic feet airships to out-Zeppelin the Zepps.

CHAPTER V

WHAT IS AN AIRPLANE?

"See here, Orvie," said his father to him, a couple of months after the crashing of their plane and the parachute drop which had saved both their lives, "I've got something important to talk to you about. You've been playing about with airplane engines ever since you were big enough to know the difference between them and a steam-roller, haven't you?"

"Almost, Father."

"And you fancy you're a pretty good mechanic?"

"You've said I was, for my age."

"You are, so far as that goes, though you've a pile to learn, yet. Now, as you know, I half-promised your mother that the first time I crashed, with you aboard, even if we escaped injury, that would be my last flight. She's superstitious and thinks that if I escaped a smash-up in all my war-flying, I oughtn't to risk it now."

"But flying's ten times safer than it was in the war!"

"Of course it is, but you'll have a hard time making

your mother see it. She's been worrying me, lately, to promise that I'll do my best to keep you out of the flying business."

"You didn't promise, did you, Father?" queried Orvie, anxiously.

"No, Son, I didn't. You've got the flying sense, to start with; your heart is in it, for another thing; and it's not only a growing business but also the nation's first line of defence. I told your mother, on the contrary, that I was going to do my best to make you a thorough airman, not merely a barnstormer pilot."

"I'm glad of that, Father! And there is a real future in flying, I'm dead sure."

"No doubt of it. Now, while I've been wondering what would be the best way to start you, for you're too young to get into the business in the ordinary way, a chance drops out of the blue sky — just the way for it to come."

"For me?"

"For you! A very good opportunity, too. Do you remember Matt Logan?"

"Your old flying pal, Father, who told us all those hunting stories last autumn?"

"That's the man!"

"Of course I remember him! He sent me a couple

of gemsbok horns as a trophy. I've got them up in my room now, and never shall forget how proud I was to have them."

"So you have, Son; I'd forgotten about them. He took a fancy to you, I remember, and doesn't seem to have forgotten it. I suppose that's because you're naturally a good shot and keen on flying, and those are the only two things he cares about. Well, I've just had a letter from him. He writes, half-humorously, to know if you've invented yet that new engine you were talking to him about, and if you're as mad as ever over fixing up old ones."

"Just as mad," said Orvie, grinning. "Madder, if anything."

"But there's a serious note back of Logan's letter, too. He wants to do some big-game hunting up in the Hudson Bay country, this summer, and would like to take with him a mechanic-pilot who has some hunting gumption of his own. How would that suit you?"

"Oh, Father; I'd like the chance!"

"I thought you would. Well, it might be a good chance for you. Logan is a first-class pilot — one of the best — and is a fair mechanic, besides, though he hates to handle a monkey-wrench — some folks are made that way. Now, you really like tools. I re-

member your trying to unscrew a propeller hub outer nut when you were only seven years old."

"Without taking out the cotter-pin," admitted the boy, laughing.

"Yes," agreed his father drily, "so there wasn't much danger that you'd succeed. And you were talking piston displacements when most youngsters of your age thought of nothing but batting averages.

"But merely being interested in engines doesn't make you a mechanic, Orvie, and still less does it make you a 'trouble-shooter,' and that's what Logan wants. He can pilot a plane with half the wing shot off and no rudder and still make a safe landing — he did that very thing in the Argonne, during the War — but I wouldn't trust him to inspect a sewing-machine for me, much less an airplane engine. And if the insulation on half his wires were worn off, he'd never notice it."

"I see," said Orvie. "He wants some one to go over his engine after every flight — regular inspection stuff. That's a responsibility!" added the boy gravely.

"It is!"

"Why doesn't he take a regular mechanic?"

"Because he wants some one who knows a bit about camping, and who can hit a barn-door at twenty yards

with a shot-gun. You're an Eagle Scout, aren't you?"

"Right!" said the boy proudly, "I got my Eagle, the youngest chap in the State!"

"And I know, myself, that you can shoot. Logan knows what he's about. You see, he'll do all the flying himself, especially if he's carrying passengers, for you're too young to get a full pilot's license. But it's a good thing to have some one in the cockpit who can handle the controls, if necessary. And while Indian guides can handle most of the camping stuff, they couldn't overhaul an engine."

The boy nodded.

"It sounds fine, Father! But I don't think I know enough."

"You certainly don't! But three months of an Air Mechanic's Course in a first-rate flying school will make all the difference. There isn't any age limit for the mechanical side. And you might take up Air Engineering, afterwards; mathematics doesn't seem to bother you."

"No. It's History and English, and that sort of thing that I make a mess of, at school. And I can't seem to get the hang of Latin, at all! What use is it, anyway?"

"More than you think, Son. But if you go into

flying for a living, you won't need Latin much. You'll need other things, though. If I send you to Flying School 'way younger than the usual age, they'll be apt to ask you a lot of questions, just to find out if you've got the simpler principles of aerostatics and aerodynamics clearly in your head. A Flying School isn't exactly an Infant Class."

"What sort of questions, Father?"

"Well, things like this: What's the difference in principle of flight between an airship and an airplane?"

"I could answer that," said Orvie, promptly. "An airship depends on buoyancy, hydrogen or helium being lighter than air; a gas-bag filled with hydrogen is lighter than the volume of air which it displaces and so it rises, or is sustained in the air. That's the same principle as a ship, the hull of which, being filled with air, is sustained by the heavier medium, water.

"An airplane works more like something on land. Air weighs 13 cubic feet to the pound. It has a certain definite resistance. By exposing a flat surface at high speed to the air, the resulting resistance of the air gives a solid reaction, so that the wing of a plane is supported by the air, just as the wheel of a wagon is supported by the ground."

"Why isn't the wing of a plane flat, then?"

"Because a flat wing would make a swirl of air behind it, with a resulting suction, which would drag the plane backwards and check its speed. Mr. Logan explained that to me, one day, when I showed him an aeroplane model I was making. Wings are curved or cambered, though the camber differs in different makes of plane. That, he said, was because all the rest of the machine was built in proportion. Some planes have wings much flatter than others."

"So far so good," said his father. "You have the hang of that, all right. Now, suppose a sudden gust of wind should come under the wing of a plane, say at the minute you speed into a squall and are climbing. Wouldn't that drive up the wing to so sharp an angle that the plane would shoot up like a rocket?"

"First place, it wouldn't shoot up. A plane isn't a rocket. It would reach the 'burbling point', or the angle at which a plane won't climb."

"As you like. But about the squall?"

"A sudden gust would try to lift a plane up, right away, and it would, too, if it wasn't for the tail," the boy answered. "The Wrights found that out, long ago, and they experimented with extra sets of gliders, both before and behind. But behind proved to be

better. The tail of a modern plane has horizontal fins, like small wings, and — "

"Why are they so much smaller than the main wings?"

"Oh, my model-making taught me that," replied Orvie confidently. "Don't forget I got second prize, last year, in the State contest!"

"Well, what did it teach you?"

"The tail-fins are so far behind the main wings — no, that's wrong! — they are so far behind the center of gravity, I meant to say, that they act like a sort of lever, the fulcrum of the lever being nearer the wings than the tail. If a gust sends the wings up at a slope, the tail points down. Since it points down, it presents itself to the wind, and the wind slaps it up, bringing the nose down again. The same thing happens when the wings point down suddenly; the tail comes up and the wind knocks it level again. If it wasn't for the tail, a plane might easily be blown up to too steep a climbing angle, and it would stall. Then comes a tail drop."

"Do you know just what a 'stall' is?"

"Pretty much the same thing as a 'stall' on a motor-car, isn't it? A flivver stalls on a steep hill because the power of the motor isn't big enough to force the weight of the car up against the downward pull of

gravity. If I've got the idea right, the steepness of the hill reaches a point where the pull of gravity is exactly equal to the power of the motor, and when the initial impulse is checked by friction, these two forces balance. Isn't that it? The explosive force in the cylinders of the engine is no longer strong enough to drive down the pistons against the combined check of friction and gravity, and the engine stops or stalls.

"In the air, much the same sort of thing happens. If the nose of the plane is pointed too high, that is, if it's going up too steep a hill, gravity gets a big drag on it, the engine can't develop enough power to make speed enough to increase the resistance at that angle, and the machine starts to drop. The plane loses speed, and as it's speed which makes the air resistant enough to act like a solid, the slowed-up plane isn't held up any longer.

"In a way, it's something like trying to drive a tin Lizzie up an ice toboggan-run. The engine might go on, but the wheels wouldn't grip. It's a different kind of insufficiency of support, but it acts the same. Even on an ordinary hill, a car would run downwards after stalling, if it wasn't for the brakes."

"And aren't there any brakes on a plane?"

This sounded like a catch, but Orvie answered,

"None. At least," he added more cautiously, "no

mechanical brakes, though, lately, slots in the wings are being used to check stalls. I don't see how there could be any real brakes — unless something develops out of the Auto-Gyro principle. After all, the car doesn't make the earth solid enough to hold it, the earth is solid already; but an airplane has to make the air solid by its speed, and the faster it goes, the more solid the air becomes."

"Prove it!"

Orvie pondered a minute or two. He knew the principle, but he had never tried to put it into words, and it was hard to meet the challenge.

"It's hard to explain, Father," he said at last, "but it's easy to see how it works in taking off. Suppose there's a 20-mile wind blowing across a landing-field. If I taxi at 40 miles an hour, with the wind, and try to take off, I won't do it; I'll hit a tree, or a fence, or a telegraph-pole, or something."

"Why?"

"Because, although I'm going 40 miles an hour in relation to the ground, I'm only going 20 miles an hour in the air, because the air is going 20 miles an hour in the same direction, and it's on the air that I've got to climb. But if I taxi 40 miles an hour across the field against the same wind, I'll take off easy, because the wind's 20-mile speed is added to

my 40-mile speed, so that I'm going 60 miles an hour against the air."

"And how does that make the air solid, when it is such a yielding substance?"

"Solidity is resistance, isn't it, Father? You can walk and not feel the air in a calm, you've got to battle against a strong wind, but a hurricane will drive you backwards. The air has become solid enough to act as though some solid thing were pushing you. Very few hurricanes ever reach as high as 100 miles an hour, and an airplane flies 120 and more. The wings, then, are actually gliding on a solid air-surface, like the wheels of an automobile on solid ground."

His father smiled.

"I don't know whether a Professor of Aerodynamics would be entirely satisfied with that explanation," he said, "but the principle of the thing is there. You'll learn about resistance coefficients, later. All right, you say it's the pressure of air on the tail which keeps an airplane level, or stable on its horizontal axis. Now what keeps it level on its lateral axis?"

"I don't think I understand it, quite," the boy admitted. "So far as I can make out, it's a question of the design of the wings, being made up of the Angle of Incidence, or 'rake' of the wing, and the camber or

curve of the wing, the whole forming a center of air-pressure which must be figured out in relation to all the other parts of the plane. Both wings, of course, must be rigidly the same in size and angle. You explained that to me, one day, when the warping of a strut threw one of our wings the teeniest bit off."

"Is a big wing more stable than a little one?"

"Yes, in horizontal flying. But I suppose the size of wings must be proportioned to weight and speed to the fraction of an inch."

His father nodded in approval.

"If you've learnt how scrupulously exact everything has got to be in airplane designing," he said, "you've made a good start. Lateral stability not only means stability in horizontal flying, but the power to regain stability from all sorts of slips and slides and spins. Is there any other kind of stability to bother with?"

"There's vertical or normal axis stability," said Orvie promptly. "That's a kind of normal center of gravity at a given middle point of the plane, by which it can turn either right or left, up or down, with equal ease and speed."

"Very good. But, so far, there's nothing to prevent a plane from rolling first to one side and then the other. You've got enough stability to keep her level,

once you're going level, but, if she starts to roll, what's going to stop her?"

Orvie looked at his father in puzzled bewilderment.

"I'd never thought of that!" he explained. "There must be something else." Then, after a minute's hard thinking. "No, I don't know."

"Good thing I ran over these first principles with you, Son! This is important, and goes far to make an airplane fool-proof. Think! If you stretched a string from wing-tip to wing-tip, would the string lie flat all along the wing, in other words, are the tip-ends and the fuselage-ends of a wing level?"

"Not by a long shot!" ejaculated the boy. "The ends are always higher than the middle, sometimes a lot, sometimes only a little, according to the make of the plane."

"Why?"

"I never stopped to think."

"Well, think now. The wings slope upwards from fuselage to tip at an angle which engineers call a dihedral angle. The principle is very simple. Suppose a machine with flat wings is rolling, there's not a very great deal of difference in air pressure between the left wing and the right wing. Suppose a machine with sharply dihedrally angled wings is rolling. By

the time the left wing is parallel with the ground, the right wing has taken an oblique angle to the ground which presents less resistance. That forces the left wing up, and if it goes too far, the right wing will do the same thing. Of course, a modern airplane is so accurately balanced that this inherent stability and correction begins to act before ever the pilot is aware of the slightest roll."

"Why didn't I think of it, myself!" exclaimed Orvie, in disgust.

"It took keen engineers a good many years of experiment before inherent stability was found," said his father, consolingly. "Now, let's get on. We've got a machine inherently stable on its three axes, longitudinal, lateral, and normal or vertical. What sends it up or down?"

"A hinged flap on the tail, the elevator. It's worked by the joy-stick."

"How does it work?"

"If you pull it back towards you, the plane goes up; and if — "

"I don't mean that. What's the principle of it, Orvie?"

"Oh, I see. When the hinged flap, or elevator, is up, that reduces by the amount of its surface the air pressure on the under side of the tail, and adds it to

the upper side, decreasing the normal downward pressure on the nose, and the angle of incidence of the wings drives the plane up. If, the other way, the elevator is pulled down, its angle gives a greater air-pressure on the under side of the tail, thus overcoming the climbing effect of the angle of incidence of the wings, and the plane goes downwards."

"Now, if you want to go to right or left?"

"There's the rudder, generally worked by a foot-control."

"And what is that?"

"Another hinged flap on the tail, only vertical instead of horizontal. It acts a good deal like the mizzen or sternmost sail of a sailing ship."

"Is that enough to keep a plane on a straight course?"

"Yes."

"Is it? And suppose your plane strikes a bump in the air and starts to yaw, veering from right to left, have you got to correct it with the rudder all the time?"

"Yes! . . . No! . . . Let me think a minute . . . Oh, I remember now, I found that out when I was making a model, once. No, it isn't enough. I was forgetting 'weathercock stability'."

"And what's that, do you know?"

"Yes, the boy who got first prize explained it to me. It's done with a fixed vertical tail-fin, so that if a plane yaws to the right, that brings the vertical tail-fin at an angle to the wind on the left, and the wind smacks it back into place; and vice versa."

"But suppose the wind were on the side, on the beam, as sailors would say, what then?"

"But it couldn't be, Father!"

"What couldn't be?"

"The wind. In an airplane the wind is always dead ahead."

"Why?"

"Let's think. Oh, yes. It's because an airplane is always going faster than any wind that blows, so it makes its own wind by the resistance of the air it's going through. That's why the wind is always dead ahead, even if the air itself is a perfect calm."

"Very good indeed, Orvie. Now, let's go a bit farther on these elementary principles. Suppose you're flying a good speed, horizontally, and you want to turn to the left; would it be enough to turn the rudder, as you would on an ocean-going ship?"

"Oh, no! You'd side-slip right away!"

"What's a side-slip?"

Orvie thought for a minute or two. He knew what it was, very well, having got into that trouble once or

twice before, but it was clear that he had never put the question to himself.

"Why," he said slowly, "I suppose it's like an automobile skidding when making a sharp turn."

"Explain a bit more, Son."

"Well, the air is always sort of slippery. Ah, I see, now! It's like those velodromes built for fast motor-cycle racing. They're built like a bowl. The angle of the inside is made so that the faster you go, the steeper is the angle, and gravity counteracts centrifugal force."

"Partly correct, Son, but not quite. Try again."

"It means, too," the boy continued, "that when a motor-cyclist is going round a turn fast, the machine must lean over, and he'd slip unless the angle of the tire was kept at exactly right angles to the surface of the track. I get it! The motor-cycle is really doing a 'bank', or the track is doing it for the motor-cycle. With an airplane, when making a turn, the whole machine has got to be tilted, more or less sharply according to the closeness of the turn, so as to present a full wing-surface to the air.

"How is that done?"

"With the ailerons."

"And what are they?"

"Hinged flaps on the wing-tips on each side of the

fuselage, or body of the plane, so fixed that when the one lifts on one wing, the aileron on the opposite side of the wing is lowered. That increases pressure on one side and diminishes it on the other, so that the plane heels over."

"Of itself?"

"No. The pilot has to do that himself by tilting the joy-stick to right or to left. The angle of the bank has got to be determined by the sharpness of the turn to be taken. A slow turn requires very little bank, but a very sharp turn means that the wings will be pointing to the earth, or nearly."

"Suppose you bank too much for a slow turn?"

"That means a side-slip inwards."

"Why?"

"That's a sort of skidding, too," the boy replied, thoughtfully. "It means that the angle has gone beyond the right position of wing-surface to the pressure of the air."

"And does every side-slip mean a crash?"

"No! You side-slip, on purpose, ever so often!"

"What for?"

"To get down into a small landing-field, to — oh, lots of things."

"Yes, Son, but if ever you take a notion to side-slip, don't leave recovery until you're too near the ground.

And, as you know, all sorts of aerobatics are safer at 3000 feet up than 300 feet up. But we're not talking about flying, now, merely the principles of flight. There's just one point more that you're not likely to know, and that is that the angle of the tail upwards must be at a smaller angle than the angle of incidence of the wings. Can you tell why?"

"That's a sort of dihedral angle, too, isn't it?"

"Exactly. It's a longitudinal dihedral angle, and gives fore and aft stability. And with the exception of proper streamlining and shape of fuselage, that's about all there is to the principles of stable flight design in a modern airplane. All there is, Son, but when you begin to work those principles into actual design, and to realize the enormous complexity of the calculations which so delicately poised a thing as an airplane requires, the thing which will amaze you is how the modern plane has developed to its present almost fool-proof stability so fast. Now a word or two as to the engine, though I know you're pretty good on that. What's the main reason of Man's conquest of the air?"

"The gasoline engine! The Wright Brothers flew first, because they were the first to get a light one. Even that weighed 12 pounds per horse-power."

"And now?"

"We've got engines weighing less than 1 pound per horse-power and developing 1000 horse-power."

"Wherein do they differ in principle from an ordinary automobile engine?"

"They don't. They're lighter, ever so much more strongly made, balanced to the nth degree, and may be either water-cooled or air-cooled. Most of the air-cooled engines, though, are of the radial type, such as the Wright 'Whirlwinds', which Lindbergh and Chamberlin used in their trans-Atlantic flights, and Byrd and Wilkins in their Polar voyages. The Army and the Navy use a lot of Pratt and Whitney 'Wasp' and 'Hornet' engines."

"What do you mean by a radial engine?"

"It means that the cylinders are arranged radially around a circular crank-case and all the piston rods operate on a single crank of the crankshaft. But there are a lot of line cylinders, V's, W's, and X's mainly water-cooled, like the Curtiss, Packard, and a lot more. The one I like best — "

"May not be the one you like next year," interrupted his father. "Aircraft engines are developing all the time. I don't say they're perfect, yet, but pretty nearly so. And the best of them are good for 250 hours' continuous running, which would take a plane around the world in a non-stop flight. Ameri-

can engines were the first to cross the Atlantic in a non-stop flight, and the first to reach the Pole."

"Perhaps the non-stop round-the-world is waiting for me to do!" quoth Orvie.

"I wouldn't try it right away, if I were you," said his father, smiling. "You'll have to figure out a way to carry the fuel load, first. But, in aviation, one never can tell. The impossibilities of to-day are the achievements of to-morrow!"

CHAPTER VI

THE FOG BOGY

Orvie soon found out at the Flying School that to make himself a good aircraft mechanic and to get some sound preliminary notions of aircraft engineering, was a very different thing from merely learning to fly.

Forty actual hours in the air, with dual controls and continuous head-telephone instruction from a competent instructor should be ample to teach any intelligent young fellow how to handle one certain make of plane in all positions and in every difficulty in which flying can put him. Many learn in thirty hours, or even slightly less. Ten hours more of solo flying is enough to give confidence. Four hours in the air with any make of machine hitherto unknown will make a pilot perfectly at home with it. In all, if the candidate for pilot has the right stuff in him, a hundred hours in the air — with good ground instruction at the same time — is enough to make an absolutely first-class all-round pilot, able to meet any emergency.

The "Flying Schools" which advertise to make a pilot over night and tempt learners by offering prices

which indicate short and insufficient training are a menace to aviation.

"To my idea," said Orvie's flying instructor to him, "there should be only one grade of pilot — the highest. No man should be allowed to fly, even in his own plane and alone, who can't pass all tests meteorological, navigational, and all the rest."

"You don't require a chauffeur's license for automobile owners," said the boy.

"No," was the quick retort, "and that's why American highways, nowadays, are little better than a quick trip to the cemetery. And Air work requires competence. In this School we don't accept any one who doesn't guarantee to take the full course to secure a Transport Pilot's license, even if he never intends to do anything but run his own plane. And not one of our pupils has ever crashed."

The U. S. Army and Navy tests for pilots remain the strictest. This is not only because there are a score of things to be learned which are not necessary to a commercial pilot — formation flying, observation, photography, gunnery, bomb-dropping, etc. — but because the Services remorselessly "wash out" all cadets who do not measure up to their standards.

There is no demand whatever for the daring and dashing pilot. What were "stunts" a few years ago

are, to-day, mere ordinary routine of training. The ideal pilot is the cautious and steady flyer, the man who does not forget, who does not lose his head, whose judgment is sound even though it is quick, and who possesses the mental twist of being as careful the thousandth time he takes off as the hundredth.

Although Orvie was entered in the Flying School for the double courses of Engine Mechanic and Aircraft Mechanic, he had also arranged to prepare for his full pilot's license as well, so as to be ready to pass the examinations and to take the test when he should reach the required age.

The boy was already a tolerable pilot. His father had allowed him to be at the controls, for limited periods, many and many a time, when the weather was fair, and the lad was as much at home in an airplane as most boys of his age would be in an automobile. He had probably been fifty hours in the air, already.

His flying instructor, however, while quite ready to admit that Orvie had the natural "flying sense," took many an occasion to warn him of the danger of "fair-weather flying."

"What's the use of knowing something, if, when you run into a cloud, you know nothing?" said he.

One day, when Orvie was chaffing a new student

who could not get it out of his head that "flying is dangerous," the instructor took him sharply to task.

"It's just as tomfool an idea to say that flying is always safe," he said, bluntly, "as to say that it's never safe. Airplanes are not fool-proof, and they never will be, any more than automobiles are. There are fools a-plenty. Under ordinary weather conditions, and in the hands of an experienced pilot, an airplane is as safe in the air as an automobile is with a good driver on a busy highway, safer, on the whole.

"But, Orvie, taking off and landing require much more care than any automobile driving does, and if you'll take the trouble to analyze fair-weather aviation accidents, you'll find that 75 per cent. of them, or more, are due to pilots' errors. Structural weakness in a modern plane is rare, very rare indeed, and engine trouble is a thing of the past in multi-motored planes."

"I haven't ever had any trouble landing," said the boy, jauntily.

"Which isn't to say that you never will have," came the grim retort. "You oughtn't to, flying out of a proper landing-field and back again, and, as I've said, flying from airport to airport in fine weather is actually easier and safer than going at a fast clip on a busy country highway.

"But what I want to get into your head, Boy, is that Aviation isn't going to stay a fair-weather job. The air-mail plane, for example, has to fly by night as well as by day, and the pilot has to do his best to get the mails through, even in snow and fog. If bad weather delays the mails, people will accept it, now, for the business is young. They won't, for long. In a few years both mail and passenger planes will run from New York to 'Frisco with the regularity of a Transcontinental Limited, now; passengers will have to become so confident that they will pay no more attention to coming down to a landing-field than they do, now, when a train stops at a station."

"Yes, sir," said Orvie, "I suppose that's true."

"That's why this School refuses to give any 'fair-weather' course. We train full-licensed or Transport Pilots, and only prepare private pilot's licenses as exceptions and on condition that the course is to be resumed."

"I've done enough work and flying for a private license, haven't I?" queried Orvie.

"Plenty. And when you're sixteen, in a few months, we'll let you go up for the Department of Commerce test, but conditionally, as I said. For you, though, Orvie, it's especially necessary to learn all you can, all the more if you're going up to Canada,

where there won't be any daily weather reports coming in to Hudson Bay. I'll lend you some meteorological books; you can study them in the evenings. Weather is a bigger subject than you imagine.

"I want you to get it firmly fixed in your head, Boy, that the finest flyer in the world may find himself in a tight box when it comes to bad weather or fog. Take the case of Byrd. If ever a man had bad luck on a trans-Atlantic flight, it surely was Byrd. He had it at the beginning, and it stuck to him all the way through, although all the three Navy men were true blue, and the big three-motor plane worked like a charm.

"The trouble began right from the start. Fokker himself, designer of the plane, took the controls for the first test flight, but the machine proved to be nose-heavy, and even the inventor could not make a landing; the big plane crashed while landing at more than a mile a minute, and turned over, pinning and injuring everybody. No one was fatally hurt, but two of the men, Noville and Bennett, had a narrow escape from death, and the hospital folk only just pulled them through.

"The *America,* Byrd's plane, was an experimental plane, in a way, that is, the flight was not intended merely as a hop across the ocean, but as an evidence

that a big three-engined plane, able to carry passengers, could make the trip. You see, Orvie, what a good many people don't realize is that, because of fuel considerations — and design as well — a multi-motor plane has a shorter cruising range than a single-motor plane. Byrd's first great test was to get into the air with a load of over 15,000 pounds. He did it only by a hair, for the rope holding back the machine broke before it could be cut, and the plane started to taxi before the engines were thoroughly warmed up.

"There's no need to tell you all the story of that trip, but I want you to realize, Orvie, what bad weather means. Byrd struck fog on reaching Newfoundland, and could get no bearings before striking out to sea. He flew for 2000 miles without seeing either land or sea — a record! In order to get above the fog — or to try to — the engines had to be run full speed, with a heavy fuel consumption, for, as you know, Orvie, the higher you go the more rarefied becomes the air and the greater must be the speed to support a plane. They were flying two miles high, and what Byrd feared most was ice forming on the plane. That might mean that the *America* would drop into the sea. And, sure enough, ice did begin to form, so that the plane was made to drop into the thickest of the fog, a little distance above the sea.

"All steering was necessarily by instruments, and what worried Byrd most was that he could not tell whether the wind was against him or astern. In other words, while he could tell his air-speed, he could not tell his ground-speed. A 20-mile wind with him meant a ground-speed of 120 miles an hour; the same wind against him meant only 80 miles an hour. Half that difference would mean success or failure.

"It wasn't until well on in the second day of continuous flight that the *America* caught a radio message, first from one steamer and then from another, which gave the plane her exact position, of which, at that moment, Byrd had but a general idea. He knew through how much air he had flown, but not over how much sea. He found he had drifted south, but that he had had a following wind of 30 miles an hour, by great good fortune, and had made splendid speed.

"In the afternoon of the second day, the *America* ran clear out of the fog, and radio signals began to be received from all parts of Europe. It was easy to get direction, then, and the big three-motored plane soon was humming over France, having touched the French shore near Brest. At that point, the weather was good, but it looked thick ahead. The radio expert on the *America* got word from Paris that the weather was thick and squally.

"Night came on, and with it came rain, fog, and heavy squalls. Only at rare intervals could the lights of a town be seen. The air was terribly bumpy, and it tossed the heavy plane about like a feather — but the engines never missed a stroke. The compasses were not working as they should, and even the earth-induction compass was a little off. The instrument has been developed to perfection since.

"Byrd, himself, tells the rest of the story this way:

" 'About the time we expected to hit Paris, we got temporarily out of thick weather. I saw bright lights ahead and a revolving light which I took to be Le Bourget (the great landing-field at Paris). Our dead reckoning showed us to be just about at Paris.'

"Remember, Orvie, it was still dark, foggy, and rainy, with vicious wind-gusts and driving squalls.

" 'I thought our troubles were at an end. I wrote out the following radio: "Paris is in sight. It has been a great trip. I wish to tell you with enthusiasm that Noville, Acosta, and Balchen have faced grave dangers with the greatest possible courage and calmness."

" 'That radio was never sent. I looked down and saw the revolving light flash for an instant on water.

" 'It was a lighthouse!

" 'We were somewhere on the coast of France.

" 'The compass had gone wrong — had taken us in a great circle. There had either been some local affection of the compass in the plane, or the pilot's dial had stuck badly. We tapped the dials, checked them with the extra standard compass that we carried, and got them O. K.

" 'Again we set out for Paris and again were tossed about in the storm and darkness. It was raining very hard on the coast, and visibility was bad. It was much stormier inland. We afterwards found that the centre of the storm was over Paris. The inky darkness was broken occasionally by the flashes of our searchlights as we needed them temporarily, and the fire from the engine-exhaust pipes. The rough air made it a little difficult to steer, especially in the darkness, but we kept a pretty good general course.

" 'Finally our dead reckoning showed us to be at Paris, but we could see nothing — nothing beneath us — nothing but the luminous lights of our steering instruments. We had got to the point beyond which, if we had continued, we could not have returned to the coastal waters on account of diminished gasoline. We knew that we should need a few gallons of reserve in order to cruise around for a landing-place that we might not even then find.

" 'I believe at the moment we turned we were near Paris; our motors were heard by many people at Le Bourget through a sound intensifier, but I could not flirt any more with the lives of my shipmates. Had we tried to land at Le Bourget in that thick weather, we should probably have crashed and almost certainly have killed many people in the waiting crowds. The only thing to do was to turn back to water.

" 'It would probably be difficult for the layman to visualize our predicament, tossed around in the inky darkness of the storm, drenched by rain, actually above our goal, and forced to turn away because of bad weather.

" 'But the decision to turn back did not carry safety, either. It meant that, even if we should find water, we could not be certain of landing without disaster, because I never heard of any one landing in the water when it was pitch dark and when the water could not be seen.' "

"That's one point," commented Orvie, "where the airship has a better chance. It can keep in the air without using fuel; the airplane can't."

"That didn't save the *Dixmude,* or the *Shenandoah,* or a dozen others," the Instructor replied. "But let Byrd go on with his story:

"'We set a course for the lighthouse we had seen. The wind might blow us off a bit in the darkness, but, if the fog were not too thick, there, we were confident of hitting it, provided we were where we thought while over Paris. Much of the way we could see nothing beneath us and we had to pull in the antenna of the wireless to keep it from hitting objects on the ground. But, at last, we emerged from the mists, and there was the lighthouse before us.

"'We cruised over it slowly, but, in spite of the light, the area around it was black, and we could only guess its topography. We had hoped there would be a beach. By the quick flash of the revolving beacon we could tell that we were over water and dimly distinguish the shore-line. We could not discern the character of the beach. It was still raining and dismally thick.

"'We decided to land near enough to the beach-line to swim ashore, if necessary, and to salvage the plane if it were not too badly wrecked. At the same time we should be far enough away to miss the rocks, should the beach be rocky. That, of course, we could not tell.

"'We now dropped a number of navigation flares as nearly in a line as we could, about 100 yards from the beach-line. They all ignited, and although they

made a light in a pool of blackness, we hoped we should be able to judge the distance of the plane above the water as we descended. Of course, if we could not judge it, we should go into the water at flying speed, which would smash everything badly, since water does not give much when hit hard.

" 'Those hours in the black storm had not been pleasant. I felt myself entirely responsible for the lives of my shipmates. I don't believe they thought there was much chance of getting down safely, but still they faced gallantly, with steady courage, whatever fate lay ahead. In a few moments the story would be ended, but to the last they calmly obeyed orders.

" 'Balchen happened to be at the wheel. I gave the orders to land. The plane was in control, and the engines functioning perfectly; for 42 hours they had made some 1500 revolutions per minute without missing a beat.

" 'As we neared the water, we could not see it; only the flares ahead of us and beneath us.

" 'The wheels touched, and though the landing gear is secured to the plane with a tremendous factor of safety, it was sheared off, along with the wheels, with hardly a jar of the plane, as though a great knife had cut it, thus demonstrating the tremendous resis-

tance of water when hit by a rapidly moving object. No one had predicted that.

" 'It seemed just a second after that the crash came. I suppose I was dazed a little. I know I got a stiff blow over my heart that made it beat irregularly for many months afterwards.

" 'I found myself in the water, outside, swimming around in the pitchy dark and rain.

" 'I could hear Noville calling for me, but not another sound in the extraordinary stillness which contrasted so vividly with the roar of the great motors which had been pounding on our ear-drums for 42 hours like the tom-toms of Hades.

" 'The plane instantly filled with water. Noville was getting out of the window . . . I found Balchen slightly caught under water and trying to extricate himself. He, like Noville, was somewhat dazed. . . . Thinking that Acosta must have been caught under the water in the cockpit, we dived down, but he was not there. A moment later he appeared, apparently from nowhere, swimming toward the wing.

" 'With grunts and groans we dragged ourselves upon the wing. . . . Noville, though dazed, was carrying out his orders given before leaving the States, which were to rip up the emergency cabin in case of landing in the water and pump up the rubber

boat. He was at his job, though he could hardly stand up and was falling every minute or two. . . . As the wing was almost flush with the water, there was no difficulty in launching the boat, and wearily we made for the shore in the dark. We had reached Europe, and when, a couple of hours later, we salvaged the United States mail, we had accomplished the first trans-Atlantic air mail in history.' "

"Wasn't that the same plane, rechristened the *Friendship,* which took Amelia Earhart of Kansas across, the first woman to fly the Atlantic?"

"It was, and if the mist had been just a little bit less dense, the *Friendship* might never have snuggled down on the coast of Wales. It was touch and go, all the way, because the radio went dead. Two of Lindbergh's parachute jumps and abandonments of air-mail planes were due to the fog bogy.

"Chamberlin's great flight missed its final triumph at Berlin for just exactly the same reason. The *Columbia* reached Cornwall, England, in 21½ hours, cracking good time, but Chamberlin wanted to get to Berlin, and he resisted the temptation to land, although it would soon be dark and the weather threatened storm. There was bad fog ahead, but Chamberlin figured that fog very seldom goes above 15,000 feet and he could easily go to 18,000 or more.

"That's where Chamberlin's bad luck came in. He took the *Columbia* up to 20,000 feet, where the controls were hardly effective, and still the fog lay higher. Nothing more could be done. The plane had reached her 'ceiling'. Undoubtedly, if the *Columbia* had been better equipped with instruments, and Chamberlin had not been so absolutely worn out with forty hours of continuous flying — for the passenger-owner, Levine, was not an experienced enough pilot to be trusted with the controls at night and in thick weather — the *Columbia* could have been driven through the fog. Not daring to go through, he cruised backwards and forwards until dawn. Let him tell his own story of what happens in bad weather to a pilot who isn't an ace!

" 'Dawn came at last, and a welcome sight it was! Fatigue had made me light-headed by this time. I still knew what I was doing, but a feeling of unreality was creeping over me and I knew that, unless I rested there was danger of my passing out. It was light enough for Levine to handle the ship.

" ' "See what you can do with her for a while", I said, "I've got to have some rest."

" 'And I shoved back on the gas-tank shelf in blissful relaxation.

" 'We were still at an altitude of 20,000 feet or

more, and Levine was following my example of killing time until it was full daylight. All went well for ten or fifteen minutes. Just what happened then is hard to say, but flying in thin air at this height required more skill than Levine ever had been called on to exert, and it is probable he lost some altitude. Or he may have started down one of the promising cloud valleys, only to find his progress blocked at the other end. Either this, or in trying to lift the Bellanca over a ridge of fog after losing a little altitude, he got us into the mist.

" 'It was a matter of seconds, then, until he was hopelessly bewildered and utterly without sense of direction. Inevitably he pulled the *Columbia* up into a stall.

" 'If she had been an ordinary airplane, then, she would have gone tail-spinning down through the fog. Being a Bellanca, she did the nearest thing she could to a spin. Off on her left wing she went, nose down, in a steep and dizzy spiral. The blinding mists, sweeping by, gave no hint of what was going on; something was wrong, but Levine had no idea what.

" 'My lethargy dissolved before the disaster facing us.

" 'Even in the time it took me to slide down off the tank into my seat, the Bellanca's wings had

started shuddering and shimmying as if they would be ripped away from the fuselage of the sturdy little ship at any instant. Her balanced rudder, oscillating in the terrific dive, was whipping the rudder-bar back and forth with leg-breaking force and shaking the rear end of the plane with such violence that I expected the whole tail to be torn off.

" 'Never in my life have I felt that death was so close or been so badly scared. Levine, on the contrary, (with the odd failure to realize that flying has its hazards, which is so characteristic of him) was enjoying the experience hugely. When the ship got beyond his control, he had shut off the motor and then taken his hands and feet off the unmanageable controls entirely.

" 'He was sitting there, laughing, and he told me afterward that he had been amused because the *Columbia* was behaving like a "bucking bronco." It evidently never occurred to him that the next "buck" might take us both into eternity.

" 'So violent was the action of the rudder-bar that it would have been utterly foolhardy to try to stop it all at once. Instead, I pushed my feet down cautiously to catch it at the end of its vicious arc and "dampen" out the terrible vibration that seemed about to carry away the tail. I was as much at a loss

about direction and what was going on in that fog as was Levine, but the plane's behavior and the frightful rush of air told me that we were going down at tremendous speed.

" 'The altimeter needle swept past the hundred-foot marks like the indicator of a swift elevator clicking off the floors in a great office building. It was the bank-and-turn indicator that told me what the plane was really doing — a diving banking turn to the left which was taking us down, down, down.

" 'Our air-speed indicator had calibrations only as far as 160 miles an hour, but the hand had passed this mark and was jammed up against a dial post as if it were going to push it out of the way.

" 'It is hard enough to take a plane in normal flying position, go into a cloud and keep on an even keel even when you have the proper instruments for "blind" flying. It is so much harder if your instruments aren't all they might be, that I had been wandering about all night in zero cold above the clouds rather than try it. But to take a plane that is out of control in the fog and ready to fall apart from vibration and to make it tractable again is one of those jobs that just can't be done until you have to do it.

" 'The first thing I did was to smother the rudder

with my feet in a progressive choking-down maneuver that stopped its wild oscillations. Then I ruddered out of the weird spiral dive into which we had fallen, my eyes on the bank-and-turn indicator until it told me we were going fairly straight ahead. After that it was a relatively simple matter to pull up the Bellanca's nose until she lost her comet speed, and the inclinometer and speed indicators showed she was reasonably near level flight again. Writing about it now, I can see that this all sounds easy, but in actual accomplishment it was a difficult matter; probably the hardest job I ever faced in my life.

" 'We had fallen into trouble at approximately 21,000 feet, and by the time I had the Bellanca under control again, the arrested needle of the altimeter stood at 4000 feet! In the brief space since the plane had started her wild plunge we had dropped more than three miles toward the earth!

" 'There had been one factor in our favor — it had started to get light. We were still in thick fog when I got the *Columbia* under control again, but it was light enough for me to tell when — and if — we came through the bottom of the clouds. I knew we were somewhere over Germany, unless my calculations were all wrong, and I knew also that the Harz Mountains push up to 3000 and 4000 feet in many places.

It would be too bad to meet one of those peaks in the fog, after having just pulled out of one nasty mess.

" 'I wiped the cold perspiration off my face, cleared the motor, and stuck the Bellanca's nose down again. Ceiling or no ceiling underneath, we had started down and we had to go on through.

" 'Would we come out all right, or were we about to smear ourselves and the *Columbia* all over a rugged German landscape? If we hit a valley, there was little likelihood that the fog would extend all the way to the ground, but there was every possibility that some of the mountain tops were shrouded in the mist through which we were flying. Thus I had succeeded from one worry to another. Levine was as unperturbed as ever.

" 'The clouds grew thinner and began to be broken during the last 2000 to 3000 feet, but it was still too near dawn to distinguish anything below. Between 1000 and 5000 feet we came through the ceiling altogether and found ourselves flying in rain and mist over a body of water. The visibility was poor and we thought at first we must be over the North Sea, as only one shore-line was in sight. It turned out to be a river, however, and presently, a mile or so ahead, we saw the glow of lights against the low-hanging clouds. We made for them and found they

were a series of blast furnaces at the edge of a sizable manufacturing town.

" 'We flew round and round in the rain, when we saw some white flares which were being fired into the air, off to one side of the town. The attendants, there, had heard our motor and guessed our identity. We got the direction to Berlin by swooping over the aerodrome not more than twenty feet above ground. We had about ten gallons of gas left and could go another hundred miles.

"We flew through rain for the first fifty miles, then it stopped; the ceiling gradually lifted to 2000 feet and the weather began to clear. If only we had been able to get through the cloud masses a few hours earlier! How far we would have been now! What a shame that we couldn't have crossed over into this fair weather area and been far on our way to Berlin or Warsaw!

" 'It was now nearing six. The gauge stood at zero and I knew there was gas for only a few minutes more. But Levine wanted to go on, to fly literally to "the last drop of gas" and take our chances on getting down without damage to the *Columbia* when the motor finally quit.

" 'I had him climb over the tank and stand in the rear part of the cabin to keep the plane from nosing

over when she came down, in case the field proved to be soft. With her fuel tanks empty, she was decidedly nose-heavy.

" 'Ten or fifteen minutes after the fuel gauge quit working and I had recommended landing, the motor faltered for the first time since we left Roosevelt Field, coughed once or twice, and stopped. At the first warning my mind was made up on two likely-looking wheat fields below, adjoining each other but separated by a road.

" 'Down came the Bellanca, maneuvering for a "dead stick" landing into the wind. I slipped her into the first field and leveled out, the *Columbia's* wheels swishing along through the wheat before they and the tail skid struck the ground together. She rolled roughly to the road and bounced over it pretty savagely, continuing so far in the short field that I had to "ground loop" her to keep her away from a fence. It was a severe test for the landing gear, but everything held. The Bellanca stopped dead still, a little wet from brushing through the standing grain, but unscathed. Our New York-Germany flight was over, 43 hours, 3905 miles, having broken the long-distance flying record of the world — Lindbergh's mark of two weeks before — by 295 miles.'

"The Ireland-Canada flight of the German

Bremen, although it was a true crossing of the Atlantic from East to West, lost much of its spectacular glory by the smash-up of the *Bremen* on an island off the coast of Canada, after the fliers had been admittedly lost for hours because of fog and tempest. Koehl and Fitzmaurice faced terrible weather, and when land was sighted they thought it was Greenland or Labrador. Even good navigators can be several hundred miles off in such a case. It proves, if anything, the splendid work of the American west-to-east fliers.

"But you see, Orvie," the Instructor concluded, "that, when men like Lindbergh, Byrd, and Chamberlin find themselves forced to the very last notch to cope with bad weather, long-distance flying requires not only the most skilful pilots and the toughest nature, but also experienced navigators and men absolutely at their ease in all the difficulties of 'blind' flying. That, my boy, is what you've got to strain to reach yourself. The real flier is the man who can successfully wrestle with the Demon of Storm, and — still more difficult — evade the smothering clutch of the Bogy of Fog."

CHAPTER VII

INTO THE WILDS

THE four months spent by Orvie in the Flying School, with special attention to the work of a mechanic, made him tolerably efficient; especially did he learn to realize the absolute and imperative necessity of going over a plane and its engine after every day's flight. He learned, too, that the right time to make sure of the conditions of a trip is before the start, not after it.

Major Burwell, Commandant at Bolling Field, has put to an end forever the story of Lindbergh's "luck," showing that no aviator could ever be more scrupulously methodical and careful than "The Lone Eagle."

"His thorough preliminary studies," wrote Major Burwell, "class Lindbergh as a sound, intelligent pioneer and aviator, rather than as a fly-by-night, dashing, dare-devil, stunt-defying pilot. . . . Lindbergh was in charge of his own arrangements. . . . Every detail, both of technical and flight nature, was worked out with the extremest care."

A good idea of Lindbergh's intensive scrutiny of the smallest detail that might hinder a flight is seen

in the description of his preparation for the take-off in his famous flight to Mexico. The take-off is always one of the most difficult and dangerous parts of a long non-stop voyage, as the lamentable death of Lieutenant Commander Davis and Lieutenant Wooster in the *American Legion* proved. The *American Legion* had shown herself a magnificent plane, and Davis was one of the best fliers in the country. But the great plane wouldn't rise smoothly, and when Wooster tried to land her, less than one minute after she had taken the air, the *American Legion* dug into the mud, turned upside down, and slid into a pond, trapping the two aviators in the cockpit under water.

"Lindbergh planned his take-off and executed it exactly as he planned; therefore he makes light of it; yet no airman of experience, knowing all the conditions, would gainsay that it was positively one of the most difficult and best-executed take-offs in aviation history. Events leading up to this flight included measuring the different dimensions of the field and different wind directions.

" 'Slim' (Lindbergh) had on three different occasions walked over the entire aerodrome, carefully noting the soft or boggy places, the rough spots, the sound, high, firm or grassy places; the ditches, depres-

sions, and obstacles bordering the aerodrome; the height of the trees, buildings, smoke-stacks, radio towers, and so on, within a mile of the field; also the fact that the river level was ten or fifteen feet below the aerodrome level at one particular end of the field where no hurdle presented itself. This was noted by Lindbergh, and he later took advantage of it.

"The field was water-soaked, and has no prepared runway. Two depressions run straight across the take-off, except for two narrow openings of hard ground. These spots were bordered by bog-holes caused by the recent thaw following a frozen crust. These holes could not be filled, because trucks would bog down of their own weight. 'Slim' had placed flags at these spots, not as an aid to space distances, but rather to know where the bog-holes were."

The total weight of Lindbergh's plane, loaded, exceeded 4000 pounds. It will give some idea of the exactitude of his figuring to say that he did not take a parachute because of the extra weight of 15 pounds. He almost decided to put in 30 more pounds of gas before giving her the gun. But he had figured lifting capacity to a fraction and ground friction to a decimal point. There was no luck in his quietly reasoned judgment that just that 30 pounds might spell the difference between success and failure.

Colonel Lindbergh arrives at Curtiss Field for the New York to Paris Hop.

COLONEL LINDBERGH ABOUT TO HOP OFF.

"The weight carried, the state of the ground, the 50-pound square-inch pressure in the tires, and so forth, made it imperative for Lindbergh to guide his plane from the take-off exactly over a long, narrow course; and, regardless of whether the *Spirit of St. Louis* is blind or not, Lindbergh has proved that he isn't.

"Therefore, following the course as accurately as he did; lifting his heavy load over the bad spots; easing it back to the ground without crashing his landing gear; lifting it off again at low speed; keeping the nose down with cool nerve, regardful of approaching obstacles; easing it out over the river at the precise point he had previously planned for; allowing it to settle, instead of pulling up and squashing — these constituted victory over the one single thing which most concerned him about the entire flight. This superb piece of work will stand as superb until it is frequently duplicated. It is my belief that it will stand for a long time."

Lindbergh's inspection of the engine — in company with the keenest mechanical engineers the Army possessed — would lead to technicalities if set forth in description. But no doctor, listening to a sick person's heart-beat with a stethoscope, is more careful than was Lindy to listen for the slightest ir-

regularity in the motor, testing it at various revolutions-per-minute speeds.

Government requirements concerning the inspection of aircraft are very rigid. A licensed plane must be given a line inspection — covering every detail of engine and structure in precisely the manner stipulated by the rules — in the 24 hours preceding every flight, and the results of that inspection must be written in full in the log-book of the plane under the inspector's signature. Failure to do so will cost the owner his license, and negligence in doing so will cost the mechanic his license. In addition to this, a "periodic inspection" — which requires a very thorough overhaul — must be done after each 100 hours of flight. The navigation and engine log-book of every licensed aircraft must be sent every three months to the Secretary of Commerce, and all flying is compulsorily suspended if any item in the log-book is questioned.

Matt Logan, a war pilot, had also his transport pilot's license and thus had full privileges of flying under any and all conditions. Orvie, by reason of his age, could get nothing higher than a private pilot's license. This gave him the right to fly Logan's plane, but not if there were any passengers aboard.

The plane chosen by Logan for his summer's work

was a Wright-Bellanca plane, with three "Whirlwind" engines and specially equipped with a combined landing and pontoon gear. As there are no air-ports in the Far North Woods, and as the ground is mainly forest and rock, seaplane landings would be the easiest; the hunting country is studded with little lakes.

In order to become thoroughly familiarized with this compound landing gear, Orvie spent a couple of weeks at the flying-field at Paterson, N. J., and on the salt marshes, until Logan was satisfied that the boy was perfectly at home both in taking-off and landing.

"You see, Orvie," said his chief, the day before their departure, "the tourist traffic in Canada has reached the point of being the third most important industry in that country, or, more exactly, the Dominion's third largest source of revenue, and most of it comes from the United States.

"But one thing that hasn't been fully realized is that American sportsmen are anxious for good sport, and they don't care much what they pay for it. A big-game expedition into the Canadian wilds runs into a lot of money, especially nowadays, when all the big game close to civilization has been pretty well killed off. What you might call the 'accessible fringe' is so narrow that, if you marked it on an ordinary-sized map, it would make a band only an inch

wide. All north of that, the hunting and fishing is marvelous, and the country is so absolutely unexplored that its game resources are almost inexhaustible.

"Now, to get to the untouched big-game haunts in the ordinary way is a long and costly journey; a tiring one, too, with its days of canoeing down rivers and streams, its long portages over marsh country, and heavy overland packing of camp supplies. A sportsman who has only a month to spend — and most rich men in America are busy men — is likely to waste a good half, or even two-thirds of his time in tiresome journeying to the game country and back. And it isn't every sportsman who likes to rough it too much. Some do, but most of them find camp life a sufficient change, without the actual physical exhaustion of an arduous trip.

"Then there's another thing. If a sportsman spends a few thousand dollars to go up into a hunting country, he wants to be sure that he's going to get good sport. How can he be sure? He depends on an Indian guide, mostly, and the Indian is likely not to have been in that part of the country since the season before. That's not always a sure direction; game doesn't stay put.

"Now, last month, I flew all over the country to

which I'm going to take my hunting parties, and I plotted out the stretches of the country where game could be seen and where it couldn't. I'll show you the map. You'll be amazed to see how spotty it is. Places where there ought to be lots of big game, I didn't see any at all; places where I didn't expect to find much, were rich. How could you make such a survey on the trail, when it takes a hard day's work to cover twenty miles? In my airplane I've see-sawed back and forth over five hundred miles of territory in a day.

"A couple of years ago, two well-known Canadian pilots flew a U. S. prospecting party into the unexplored territory of Northern British Columbia and the Yukon, spending the entire summer about the Liard River. They described it as a sportsmen's paradise. The lakes and rivers teemed with fish. It was common to see as many as a dozen moose standing on the shore of a lake, and, from the air, caribou and grizzlies were seen in numbers."

"Are we going up there, Mr. Logan?"

"We could, easily, if any one wanted to go so far, and we could go even farther, if a sportsman wanted barren-ground caribou or musk-ox. But there's no need. I can pick a man up at New York, Cleveland, Chicago, Detroit, or anywhere, after breakfast, and

land him in his camp the same evening with his guns and supplies. At that, I don't believe it'll cost him any more than the long, dragging journey with porters and guides, if as much. And I can guarantee him good sport.

"You remember when the Canadians first started that flying service to the new gold-fields of northwestern Quebec? Well, between Haileybury and Rouyn, it was possible to see moose almost every day, and one pilot made a point of carrying a bag of salt on his trips to dump near a moose-run. And there are any number of lakes into which a seaplane could land with ease, always on still water. Around James Bay, too, the mud flats are at times covered with Canada goose, a species of game which the average hunter has never had a chance to shoot.

"In the Laurentian Mountains, one or two sportsmen's camp hotels have been established, with an airplane service to points far in the woods, at perhaps an hour's flying from the hotel, and I know one place of the kind which has every room booked for four years in advance. Planes now run back of the Temiskaming country and into the rich territory behind the Chibougamous mining-field, in northern Quebec. The Red Lake district of Ontario is now available to the hunter. Planes operate from Lac du Bonnet in

Manitoba into the vast Manitoba hinterland towards Hudson Bay. From Calgary, the Peace River Country can be reached. Within very few years, the old canoeing and portaging trails for hunters will be a thing of the past. The airplane will put them out of commission, just as the railroad has the transcontinental trails for prairie-wagons used by the Mormons and the 'Forty-niners."

"It's a pity, in a way," commented Orvie, reflectively.

"In books, it is," retorted Logan. "But if you'd ever done heavy portaging in swamp country, after a long morning's canoeing, stung till your face was swollen twice its size by mosquitoes and the black-flies of the North, and then had to put up with some half-fried bacon and a slab of pan-bread, you'd appreciate being able to fly in a single day from some point near your home town to the actual hunting-grounds, where your camp is already prepared and guides are waiting. And, supposing an airplane like ours can take three hunters, flying 100 miles an hour, that's only costing each hunter about $75 per hundred miles — and even less; two canoemen and a guide, for the five days necessary to cover that distance, would cost you more. Take it from me, Orvie, the seaplane is the hunting-wagon of the future."

The boy grinned expectantly.

"I'll see it for myself to-morrow!"

"You will. Now, no late hours to-night, for we're going to make an early start! We're not taking passengers, this time, but we're toting all the necessities for a camp outfit which I haven't been able to send ahead by trail."

"And gas?'

"We'll refuel in Canada. I've made all arrangements. I really don't need to make this preparatory trip, but I'd like to see for myself that everything is ready for the hunters."

"How many parties are we taking up?"

"During the summer? Four — and to two different camps. That means quite a bit of flying up there, too. It's a chance for you, Orvie! You'll get a good hundred hours of flying, this summer, and that counts heavily in your favor when it comes to making application for the higher pilots' licenses."

"Well," said the boy, as he got up and stretched, "one thing I do know, and that is that the machine is in tip-top shape."

"You've been tinkering at it all day," said Logan, cocking a wary eye at him, "and if it isn't all right, you'll have lost the best flying chance of your life. More than that, too," he added, "we're going over a

good many hundred miles of country where there's no landing-place at all, and if the motor bucks, there'll be nothing for it but the parachutes."

"She won't buck," said the boy. "I'll stake my hat on it."

"You're staking your head," said Logan. "That's how important it is. Now, off to bed with you!"

The *Dan'l Boone,* a tri-motored Bellanca plane, streamlined to the last notch and showing every inch of the stability and power she possessed, was moored close to the small boat-pier.

Orvie has been the first one out of bed, and when Logan came up, the motors were just idling over to keep them warm. Everything had been packed the day before, and the chief just cast a sharp eye over the plane to see that the stowage had not been disturbed.

Both climbed in, Logan in the pilot's seat, Orvie in that of the mechanic.

"Contact!" said Logan, half to himself, from habit, for he was used to landplanes and to the whirling of a propeller by the ground crew.

The propellers of the *Dan'l Boone* began to spin. She glided a few yards, than began to get way as the engines broke into a purring roar, dashed and spattered as the speed indicator started round the dial,

skimmed the water a few times, and, as Logan gently drew back the joy-stick, she rose clear.

The load was a fairly heavy one, and the pilot leveled out, when about twenty feet up, in order to gain flying speed, and then lifted her nose again. The Bellanca climbed like a charm against the gentle wind and reached a comfortable flying altitude.

A slight bank, a half turn, and the *Dan'l Boone* was fairly headed for the hunting country of the north.

Orvie, cotton-wool in his ears to deaden a little the terrific roar of the three engines, listened intently. The motors ran regularly and smoothly and with very little vibration to the plane. Soon they had left the lake and were winging steadily over Canada.

As he looked down, Orvie saw that Logan was right about landing-places. The belt of farm-land to the north of the lakes once passed, the ground below showed craggy, and covered with stunted forest. These were not the real "woods", but the region had been thoroughly lumbered over just the same, and stumps and second-growth timber made an impossible landing condition. There was no doubt of it, a forced landing in that part of the country meant a certain crash, and there was much less water than the boy had expected.

Although he was as sure as he could be concerning

the engines, one never knew! A sense of uncertainty and responsibility began to worry him. But the three "Whirlwinds" roared on and never skipped a beat.

After three hours' flying, they came to a different kind of country. The rocks showed up less. There was a good deal more swamp and not a little tamarack forest.

Logan turned half round and pointed down. The plane was flying at about 1800 feet, with a clear sky and good visibility, and below them and ahead of them, was a serpentine-shaped black spot — a lake, the Lac du Bonnet, where the Oiseau River joins the Winnipeg, about 25 miles southeast of Fort Alexander on Lake Winnipeg, and a railroad terminal.

A few more minutes' flying, and Logan shut off the motor for a glide. The Bellanca swooped down, descending by S-turns, leveled out above the water, and just lost flying speed as her pontoons touched, running toward the pier as easily as a rowboat, coming to rest only a few yards away.

Refueling was simple, and a couple of hours later, the *Dan'l Boone* was on the way again.

An hour later, passing over a tiny lake in the Pijiki Country, Orvie saw his first moose, and shortly after, flying low, he spotted a bear charging up-hill, evidently disturbed by the roar of the motors. The

moose had not paid any attention, evidently considering that birds, however big, were no concern of his.

A couple of hours later, the little lake to which they were bound showed ahead, and a few minutes after, the Bellanca was swooping down to a landing. As she came down, a canoe with an Indian paddler shot out to meet her, and, as the plane came almost to a standstill, and taxied up, the Indian snubbed her to a mooring-post in the middle of the lake. This was nothing but a tree sunk in the lake and weighted with stones, from the trunk of which projected an upstanding stump of branch, on which was bolted a strong swivel-hook. The main propeller was immobilized, and a short pole, fitted into a socket, acted as a fender.

"Squalls rise suddenly on these lakes," Logan explained, "and, as I showed you, I have had a special band with mooring-rings riveted to the fuselage, so that the *Dan'l Boone* can swing like a weathercock to any wind, without smashing her propeller against the 'mooring-mast'. There are too many snags to let us tie up near shore."

The tents already had been pitched on a little promontory, firewood gathered, trout caught; and a good fire was blazing. There were camp beds, but Orvie,

like Logan, preferred to throw himself on the springy balsam beds such as the guides used. He would need to be up betimes, for "line inspection" was his task before the "hop off" in the morning. It proved necessary, too, for the spark gap on one of the plugs was not to his liking.

"Since we're running light and she'll rise easily," said Logan, "you take her, Orvie. Let's see what you can do. Don't let the trees bulldoze you! I've seen pilots worried in advance because they thought trees too close. What's your first move?"

"To find out the direction of the wind," said Orvie.

"And how are you going to do that?"

Orvie grinned and pointed to the top of the tallest tree.

"I swarmed that one this morning, early," he said.

Logan looked up.

A "sock," in other words, a funnel-shaped piece of stuff, had been mounted on a swivel right near the top of the tree, at a point where there was a branching, the thin top of the tree having been sawn off there.

"When did you get the time to make that?" he said.

"I didn't," said the boy, chuckling with pride. "I brought the swivel with me, in my pocket. I

read about that trick in an Alaskan Survey report, and it struck me as a good one."

Logan clapped him on the shoulder.

"Good stuff, Orvie," he said. "But the smoke from the fire usually does as well, better, sometimes, for it gives you the ground wind. But the 'sock' is useful, too. If you can think ahead like that, you'll make a flyer. In with you!"

The words of praise greatly heightened the boy's confidence, and he "taxied" the plane to the lee end of the lake.

"Just one word of warning, Son," said Logan. "Running light, you've got plenty of room to lift on the lake. When you get off, don't be afraid to level off for a bit. If you try to climb too fast, you'll stall, and squash. And don't turn on a climb unless it's at a desperate pinch!"

Orvie nodded. These were all the simple fundamentals of taking off.

Yet the warning was a good one. He had never taken off with high trees facing him, and the effect was rather terrifying. His impulse was to get off the water as quickly as possible and to climb at once, but he remembered his chief's advice, leveled out for a hundred yards, and then pulled the joy-stick back for the rise. Having gained speed, the *Dan'l Boone*

responded instantly and soared well above the tree-tops with a good 80 feet to spare.

The boy looked round to catch Logan's approving nod.

The course over the unmarked woods was by compass — the *Dan'l Boone* carried an earth-inductor compass as well as the ordinary magnetic compass, for there is a good deal of iron in the soil of the North Country — and this was a little new to Orvie. But he held his course well, and only twice did Logan pass him a little note as to change of course.

At one point, going over a low hogback, the air was rather bumpy, but the Bellanca was wonderfully stable, and Orvie had not the slightest fear of bumps. He had gone to 2000 feet altitude, giving plenty of room in case he should come to any "holes" in the air.

The landing at Lac du Bonnet was good enough, though Orvie very nearly made a "pancake" landing, stopping the plane a couple of feet in air. But fortunately she had still enough flying way, and the boy was able to ease her down. There was a little more jar than there should have been, but this was not a serious matter.

"We'll need those pontoons again, Son," was his chief's only comment. As a matter of fact, he was quite pleased, for the boy had shown himself quite

air-easy; and the three essentials in good flying are knowledge, confidence, and care.

Logan took the plane himself in the afternoon, to run into Cleveland where they were to pick up the two hunters, not only because they were going to run over several cities, but also to give Orvie a rest, for an early start was to be made in the morning, and the boy would have to overhaul the plane before going to bed.

Inspection was less fun, this time! Orvie was tired after the two days' flying and the excitement. Perfectly sure that the engine and plane were all right, he was tempted, almost, to give just a cursory look-over.

"It's good enough!" he said to himself, half-aloud.

Then he jumped as though something had bitten him.

The old flying saying came back to his memory:

"Good enough is bad enough and may kill; good is doubtful and may crash; perfect is the only margin of safety."

And he had actually thought of "good enough," and had almost yielded to the temptation!

It gave him an inward scare. He took a good two hours on that inspection, not because it was really necessary, but to punish himself.

"Anything wrong?" asked Logan, when the boy came in.

"No —." Then he told exactly what had happened.

" 'Tis a true saying," said his chief. "There's nothing safer than flying, when every detail is right, but when you're not sure, and you've got other people's lives in charge — ! I'm thinking, Orvie, that if you had done your inspection carelessly, you'd have been in a sweat of anxiety all to-morrow, just wondering if anything would happen. If you've done your uttermost, there's nothing more to worry over."

And the Bellanca gave a good account of herself, next day.

Neither of the hunters had ever been up in the air before, and they looked a little doubtful on seeing the youthfulness of the "Flying Mechanic." But Logan was doing the piloting, and Logan was an ace. The *Dan'l Boone* lifted like a bird, and settled down on the waters of Noocumpook Lake as smoothly as a heron.

The hunters were loud in praise of Logan's piloting, and swore that they'd never travel any other way than by plane thereafter.

"Providing we can always get such a pilot!" declared one enthusiastically.

"And a good mechanic," said Logan soberly. "The best pilot can do nothing with 'bugs' in the engine or with a strained plane."

"Your son, I suppose?" queried the other, as a sort of excuse for the "mechanic's" youthfulness.

"No," said Logan. "I've taken him for the summer because he's got the goods. He has my perfect confidence."

The hunters looked with a new respect at Orvie, and the boy, as he threw himself on the balsam boughs, could think of no greater happiness.

Chamberlin's Plane in Flight.

Courtesy of U. S. Air Services.

THE FOKKER AIRLINER, POWERED WITH THREE WRIGHT "WHIRLWIND" AIR-COOLED ENGINES.

Few planes—if any—can show such Transatlantic, Transpacific, Arctic, and Continental non-stop records.

CHAPTER VIII

The Stray Bullet

Early next morning the hunters started off, with Logan and the Cree Indian guide. One of the hunters, a Cleveland broker, offered Orvie one of his spare guns, but the boy shook his head.

"Thanks ever so much, Mr. Porrit," he said, "but I've got to overhaul the 'bus'."

"Why? Did anything go wrong yesterday?"

"Nothing! But a plane and its engine have got to be overhauled after every day's flying."

"Do they get out of order so easily as that?"

"No," answered the boy. "But if they do, it can be serious, especially in country like this where you can't be sure of getting to a landing-field, or a handy lake. If a motor-car stalls, the brakes are there. If anything happens to a locomotive, the brakeman can flag an approaching train. The car can be towed home; a relief crew can get to the train. But a plane and its engine must be in perfect condition, all the time, for there's no kind of rescue that can get to it in the air."

"To-morrow, then!" said the hunter, by no means dissatisfied to find the young mechanic so conscientious.

"Gladly, sir," answered Orvie, "I've never had a chance at a moose."

Next morning the party started off. The hunting of the day before had been fruitless, but, on the way home, the hunters had come across fresh moose-tracks, and it was with high hopes that they started off. The Cree led, the two hunters followed, Logan and Orvie brought up the rear.

"What's the matter, Mr. Logan?" queried the boy, after they had tramped for a little time in silence. "You seem worried."

"I am worried," said his chief. "Somebody put a lighted cigarette on my 'mascot' silk stocking, last night, and burned a hole in it."

Although Orvie, himself, had not reached the point of superstition which characterizes most aviators, he knew how much stress airmen put on their mascots.

"The one you carried all through the war?"

Logan nodded. Of Irish stock, he was to the full as superstitious as most. Not for the world would he have allowed any one to bring a flower aboard his plane, for flowers suggest a funeral; a good many

stories can be told to bear out the belief. An aviator has no objection to having his photograph taken after a flight, but woe betide the newspaperman who is so foolish as to snap a camera before one! The "last flight" is always feared, and few things have done more to fasten this belief on the flying world than the astounding number of accidents which happened on Armistice Day, though the Germans had surrendered the evening before and firing was to cease at eleven o'clock in the morning.

The horseshoe is often carried as a good-luck sign. Young animals, puppies, kittens, and even baby mice are supposed to bring fortune; but it is bad luck to carry birds — though one of the Polish aces always took up with him an imperial Pekin drake. A "magic square" is believed to have a protecting effect, and so has a wedding ring — but it must belong to some one else. But a silk stocking — not a new one, but one that has been worn — remains perhaps the favorite of all among American fliers. The best omen is believed to be the shadow of the plane reflected on the clouds below, especially when it is surrounded with the prismatic colors of the rainbow, due, probably, to the disturbance of the air by the violent currents set up by the plane.

Not for any money which could be offered to him

would Logan have flown that day, and it was clear that he was anxious and out of sorts.

Presently, from ahead, came the hoarse hoot of a barred owl.

Logan stopped dead.

"That's Pete!" he said, in a whisper. Then, in answer to the boy's look, he went on, in the same tone, "Owls don't hoot in daylight! Circle to the left, Orvie, just as quietly as you can. I'll go up-wind. If there's anything stirring, it'll get my scent and break down toward the hunters."

The boy nodded and started off, but Logan beckoned him back.

"You're down-wind," he said. "All the rest of the party is up-wind to you. Remember! No matter how good a chance you get for a shot, if the animal is up-wind, keep your finger off the trigger. A rifle bullet carries far, and, in the scrub, some of us might be right in range. Fire down-wind all you like."

"Right-o!" agreed the boy, and started off on moccasined feet, going as softly as he could.

Away from Logan, the woods seemed strangely quiet, and Orvie remembered how he had been told that every creature of the woods knows telepathically the danger from a sportsman hunting to kill, while remaining indifferent to a lumberman carrying noth-

ing but his axe. Twice he heard the piteous and plaintive cry of a loon — that despair of the keenest marksman — but otherwise the woods were silent.

Then, suddenly, quite suddenly, for he had heard no sound, a cow moose materialized on his right. As the boy was not up-wind, she had not smelt him, but she had evidently caught scent of the other hunters and was snorting quietly and trying to get direction.

The boy's rifle came up to his shoulder. The moose was not more than fifty yards away, the shoulder and head were clearly visible.

He could not miss!

Then Logan's warning came to him. He must not shoot up-wind!

Regretfully, he lowered the barrel of the rifle, and huddled himself against the trunk of a tree.

For fully two minutes the cow moose stood motionless, then some wandering puff of wind brought her the hated scent more definitely, and, disregarding noise, she crashed down-wind through the branches. Whether she saw or smelt him, Orvie could not tell, but, though she must have passed within thirty yards of him, he could see nothing of her.

The boy brought his rifle to the ready, and stole forward again.

Far to the right arose a chatter from the whisky-

jacks — Canada jays or moose-birds — clamorously informing all denizens of the woods that enemies were abroad. Arrant thieves, as well as chatter-boxes, whisky-jacks are not loved by hunters. Red squirrels came down to the lower branches and told Orvie what they thought of him — it may be a good thing that Man does not understand squirrel-language, for it sounds most uncomplimentary.

Here and there, where the ground was soft, tracks appeared which Pete, the Indian trapper, might have deciphered, but Orvie was not a good enough woods-man. One track, certainly, was bear — that was unmistakable — but the boy could not tell whether it were a day or a week old. It is only in winter, after a light fall of wet snow, that the animals are forced to tell all the secrets of their daily lives.

The morning wore on. The sky became clouded and the air sultry, the weather that black-flies and mosquitoes especially enjoy. This was Orvie's introduction to that intolerable pest of the North Woods, the tiny blood-sucking midge or "black-fly," which, swarming in millions, makes life almost unbearable at certain seasons of the year. A mosquito is annoying, but the black-fly — as hunters know — seems to have a peculiar capacity for arousing the vilest temper. "He smiles in a smoke of black-flies"

is a Cree saying to suggest that a man is so insensible as to be almost an idiot.

Orvie was not exempt. He was ready to break down and cry, not from pain, but from pure rage. He began to understand the stories of men having gone mad in the North Woods during the sultry season of late summer.

Suddenly, two shots rang out, one very shortly after the other, and, afterwards, a cry.

Orvie stopped and listened.

He had often heard that a wounded moose screamed like a man. The story was evidently true.

As all the game would have broken from cover at the sound of the shots, there was no need for further silence or care. Guiding himself by the sound of the shots and by the direction of the wind, he forged his way through the scrub to where he had heard the shooting.

Half-way there, three revolver shots rang out in quick succession:

"Bang! — Bang! — Bang!"

They came from some distance away.

Orvie broke into a run. It was the signal of distress, the S. O. S. of the woods!

Presently he burst into a clearing, close to a tiny lake, not a hundred yards across.

On the ground lay a fine stag moose, and, beside it, Porrit, one of the hunters, was standing. He was not looking at the kill, but was shading his eyes with his hand and looking along the shore of the lake.

He turned as the boy came up.

"Merrill's gone crazy," he said, bluntly, as Orvie came running up, "at least it looks like it. He blazed at the moose without even bothering to take aim, and I believe Logan has been hit."

"I heard the shots," said the boy, panting. "Where is he?"

The hunter laid a restraining hand on Orvie's shoulder.

"This isn't the time to separate," he said. "Merrill's gone with Pete. If Logan is hurt — and he wouldn't have called for help if he weren't — Pete is the only one who knows the woods."

"But, Mr. Porrit, I must — "

"I know how you feel, Lad. But trust me, wait! Pete'll be back soon enough, and we'll know the worst — or the best."

"What happened to Mr. Merrill?"

"Black-flies," said the hunter succinctly. "He's never been in this part of the country before. They got on his nerves. We stalked this stag, and I got a fair, full shot at it. Merrill was down that way,

twenty yards or so, and as the stag gave a few bounds he must have shot at the sound — I don't think he can have seen the beast, for, a second afterwards, I heard Logan's cry."

"Then it wasn't the moose!"

"That cried out? No. They do bellow humanly, sometimes. But this one dropped without a sound. . . .

"Ah! There's Pete coming now!"

The Indian came along the shore at the dog-trot which looks so slow but which eats up miles, and can be maintained so long.

"Well?"

"He — is — much hurt," said the guide in his correct but stilted English. "The bullet — is — here."

He pointed to his chest.

Porrit whistled.

"Through the lungs! Is he bleeding much, Pete?"

"With — good luck — yes. Blood — flows outside; not inside."

"If there's no internal bleeding, that's a comfort."

"What do?" queried the Indian.

Porrit shrugged his shoulders.

"I don't know any more about surgery than a baby," he said. "And the first-aid kit is in camp."

"I've passed the Boy Scout First Aid exams," put in Orvie, eagerly.

"I'm afraid that isn't much use for a punctured lung. Merrill doesn't know any more about it than I do. And," he added in a tone of acute remorse, "it was I who persuaded Merrill to come on this trip!"

There was a moment's silence.

"Can't you do anything, Pete?"

"I — can stop — bleeding," said the Indian. "Outside wound — I can fix; inside wound — I cannot fix. Boss needs doctor — quick."

"And we're two hundred miles from anywhere!"

"That's not far by plane!" said Orvie eagerly.

"Yes, but who's going to pilot?"

"I've got a pilot's license," said the boy.

"You have? Bring the plane here, then, and we'll rush Logan back."

Orvie eyed the little lake with a critical eye.

"I can't, from here," he said. "At a pinch I might be able to make a landing, but I'm not sure about taking off."

"Why not? It's a seaplane, isn't it?"

"There's not enough run," said the boy. "And the wind is wrong, besides."

The Indian nodded.

"One big lake," he put in, "not far — one mile. Carry — boss — there. Boy — bring — the airplane."

"But can you find your way to the camp alone?" queried Porrit.

"I might — " began Orvie dubiously.

"No!" said Pete authoritatively. "You — not find. We make — stretcher. Carry — boss."

Then his eye fell on the moose.

"We leave — moose — here; wolves smell — come." His roving glance caught sight of a sturdy young tree.

Orvie caught his look and guessed the meaning.

"Do you want to string the moose up, same as we do deer?"

"Moose — very heavy," said Pete doubtfully.

"It's only a few yards. We can drag it."

"Try!" said the Indian.

Using all their strength the three managed to roll and drag the moose under the tree. Orvie climbed it, with the end of the long rope which the Indian had wound about his waist after the fashion of deer-hunters, and the three men dragged on the rope, using a double purchase, until the tree was bent down as far as it would go without cracking. The hind legs of the moose were tied together, lifted to a crotch

of the tree, and the rope loosened. The tree, springing back to an upright position, lifted the moose off the ground beyond the reach of a wolf's jump.

Orvie was all impatience, for he thought this was a waste of valuable time with Logan lying dangerously wounded, but the whole affair had not taken more than ten minutes. This done, Pete led the way to where Logan lay.

Merrill was pacing backwards and forwards distractedly. He hurried towards them.

"How is he?" queried Porrit.

"Dying, I think. And I — I've murdered him!"

"Nonsense," said the broker. "Pete says he'll get over it all right. Here, take a swig at the flask! Lucky I brought some from Lac du Bonnet."

Orvie had rushed over to where Logan lay. The pilot was unconscious. Lying beside his hand was the silk stocking with the hole burned in it. The boy gave a superstitious shiver. Should he take it? No. Better not interfere. He shoved the mascot back into Logan's pocket.

Under Pete's orders, the three rapidly cut some withes and saplings, and a rough stretcher was hurriedly made, with a projecting stick on either corner. Logan was laid on this — he did not come to consciousness at all as they lifted him — and with Pete

and the boy at one end, and the two city hunters at the other, they carried him for a mile or so, coming out, as the Indian had said, to the borders of a lake.

Orvie gave a sigh of relief.

"This is all right," he said. "I can take off from here. But how shall we get him into the fuselage?"

"You — bring — canoe," said Pete. "I show." Then, turning to the two men, he added, "You — make fire. Big smoke. Airplane — find easily." To the boy: "Come! Walk quick!"

With an unerring instinct the Indian struck out directly across the woods. Orvie was young and lithe, but, over and over again, Pete had to stop to let the boy catch up. Orvie was out of breath and his legs were trembling from the pace when they reached the camp. They had made it in less than half the time it had taken them to come.

With the other Indian, the camp cook, helping, the canoe was lashed above the fuselage, and, less than ten minutes after their arrival, the plane was in the air. The Cree had never been up, before, but he accepted everything with the stolidity of his race. The smoke of the fire lighted by the hunters guided them, and the plane flew rapidly to the lake on the shores of which the wounded man lay.

Orvie did not leave the cockpit. It was amazing

to him to see with what apparent slowness, but real deftness, Pete managed to get Logan into the canoe, and, helped by Porrit, to lift the wounded man into the fuselage. The stretcher was lashed across it, and Logan lashed to the stretcher. He came to, during the process, and groaned.

"It's all right, Mr. Logan," said the boy cheerfully. "All aboard!"

"I'm coming, too!" said Merrill. "It's all my fault, and I want to see he gets every attention."

But Orvie shook his head.

"I can't take you, sir," he said.

"Why not? The plane carried us all, before; why can't it carry us now?"

"It isn't the weight," the boy explained. "But I've only got a private pilot's license. I can take Mr. Logan, because he's the owner of the plane. But if I take you, I'll be carrying a passenger, and that would cost Mr. Logan his license. Government rules are iron-clad."

"But —"

"Every minute spent in talk is dangerous," broke in Porrit. "If the boy won't take you, that's an end of it. Where are you going, Lee?"

"To Lac du Bonnet, sir," said Orvie. "It may be about twenty minutes farther than the nearest town,

but I've landed there, before. There's a doctor there, I know."

"Off with you, then! Good luck!"

The propellers whirled, the engines broke into a roar, the *Dan'l Boone* swished slowly, then rapidly through the water, rose, and cleared the trees easily.

"Good boy," said the Indian approvingly. "Now — go skin — moose."

Merrill, conscience-stricken, had little heart for the task, but it was his duty to help, and the three men returned to where the moose had been slung to a bending tree.

Long before they had reached the place, the plane was out of sight. Orvie had risen high and was running with all three throttles open to gain time. The weather was threatening, and the boy's one fear was that he would run into clouds or rain. He remembered his Flying Instructor's warning about being caught in thick weather over unknown country.

But fortune favored him. The cloud lay high. The ceiling was fully 800 feet, plenty of room to fly. He was immensely relieved to find that his close observation of the land below, on his three trips, had not been in vain, and he picked up one mark after another. It was still full light when the Lac du Bonnet came in sight. As soon as he turned off the

motor for a glide, he took out his own revolver and fired three times.

From the sheds, men came running, and a couple of boats pushed off.

The Bellanca slid down to a perfect landing, and the boats took her and snubbed her to the pier.

No words were wasted. The stretcher told the whole story.

"Lucky we got the infirmary fixed," said one. "The nurse got here just two weeks ago."

"And is there a doctor here?"

"Right on the ground. Easy with that stretcher. A little higher, Tom! Now then, boys! To the infirmary. Don't bother about changing to a regular stretcher — that'll go through the door, all right."

The news had spread and the doctor came hurrying from his little frame shack, for the permanent buildings of this advanced post were not yet all built. One man ran ahead and had notified the nurse — there was but one — and when the stretcher reached the place, everything was ready.

Logan was lifted to the bed.

The doctor's examination was brief.

"Dangerous," he said, "but not fatal. The bullet struck one of the upper ribs and glanced up. If it had struck an inch lower or glanced downwards, I

wouldn't be so ready to answer. But I think we'll be able to pull him through, unless some complication occurs."

Orvie heaved a deep sigh of relief. His flight would not be in vain.

"When did this happen?" the doctor asked, not looking up, and busying himself with the patient.

"About one o'clock, Doctor."

"Whereabouts?"

"Some miles from our camp on Lake Noocumpook."

"H'm. Far enough away! Well, if there'd been any delay and you hadn't got him here so quickly, he wouldn't have had much chance. If we get the patient through, Boy — and I believe we shall — he'll owe his life to you, and to the Wright Brothers who taught the world to fly."

CHAPTER IX

A FOREST-FIRE RESCUE

In the establishment of the camp of Noocumpook, Logan had put in an efficient receiving radio set, but it had been installed in the anticipation that either he or Orvie would be on hand to receive messages. Under the conditions, there was no way of sending word to Merrill from Lac du Bonnet that his victim had a chance to recover.

Next morning, Orvie was ready to fly back, but the doctor was not quite so hopeful as the day before. The bullet had been extracted, but there was a good deal of fever, and the boy shrewdly suspected that the doctor had not told him everything.

"Wait a day or so," he was advised, "and then you can fly back. I shouldn't be surprised if the city men wanted to return, right away. The accident must have taken a good deal of zest out of their hunting."

This suggestion set Orvie thinking. He couldn't bring back the passengers, himself, for his private pilot's license did not give him the right to do so. He

did not want to ask any of the local pilots to take the plane, for "Lake Noocumpook" was not on any of the maps, and, having discovered a first-rate hunting country, Logan desired to keep the information for himself and his clients.

The boy, who had a knack of making friends, confided his problem to the doctor, and suggested that perhaps he could persuade his father to act as pilot until Logan was better.

"But," said the boy, "there isn't any place to land a seaplane near my home, though we've got a very decent landing-field. And to go by boat and rail from here will take an age!"

"Nothing easier," said the doctor. "My brother has a three-seater Vought — a Corsair, I believe it is — and he'd like nothing better than a little spin like that. I'll ring him up on the 'phone. You can ride, I suppose?"

"Horseback? Sure!"

"All right. If Jack's not busy, you can ride over to his place — it's only about eight miles from here — while he's tuning up."

The doctor came back a few minutes later.

"Fine!" he announced. "Jack's more than willing. I've told one of the men to saddle a pony. Down the lake trail, first fork to the left, and straight

on till you come to a crossroads. Turn sharp to the right, and the house is only a couple of hundred yards away."

"Ever so much obliged — "

"Glad to do it," said the doctor. "Logan's an old friend of mine, and I'm glad to help him out, if I can."

Bursting with delight at the thought of a gallop, Orvie hurried to the stables. He was astride in a moment, and away. The little mare was mettlesome, and made good time over the soft forest road. When Orvie came to the crossroads he heard the quiet hum of idling engines. He turned sharp and rode straight up to the plane.

"You're the youngster who rushed a wounded man from the North Woods?"

"Yes, sir."

"And you want to get your father to replace Matt Logan while he's laid up? Is that it?"

"I think that's what would please Mr. Logan best."

"Your father a pilot?"

Orvie laughed.

"Congressional Medal of Honor for Air Service in the War!"

" 'Nuff said. Hop in. Where do we have to go?"

"Waxen, Ohio. Fifty miles from Cleveland."

"All right. Here we go!"

The Vought Corsair, a most efficient biplane type, climbed up powerfully and swiftly. Running at a good 120 per hour, it ate up the distance, and its owner brought her down with perfect ease on the fields behind Orvie's home.

Seeing a strange plane land, Orvie's father came hurrying out, fearing that there might be some bad news of the boy. He was relieved when his son jumped out and ran to meet him.

"Oh, Father!" he burst out breathlessly. "Matt Logan's been shot, wounded, not fatally though. The doctor says he's going to get all right again. Can't you take the *Dan'l Boone* until he's all right again?"

"Eh! What's that? Logan wounded? Orvie, you bring out news like a machine-gun! Control yourself, Son."

He stepped forward to meet the visiting aviator, who had just climbed out of the cockpit.

"I'm Dr. Tam MacTavish's brother, Duncan MacTavish," said the stranger, introducing himself. "I've heard Matt Logan talk of you, Major Lee, many's the time."

The two men shook hands.

"Is Logan badly hurt, do you know?" the Major asked.

"Girdly so, according to what Tam telephoned me this morning. It's no' canny have a bullet through the lungs. But Tam thinks he'll recover, Providence willing!"

"How did it happen?"

"Out shooting moose, Father," put in Orvie tumultuously. "One of the men got bitten with blackflies and got angry and shot wild and hit Mr. Logan. And so I brought him back, and Mr. MacTavish brought me here for you. The doctor arranged it."

"Orvie," said his father, "you're talking in such a hurry that your words tread on each other's tails, and don't make sense. Tell me quietly, and properly, presently. There's plenty of time. And it's not showing courtesy to a guest to interrupt that way!"

"It's maist excusable," said the Scotchman, "and I dinna think the worse o' the lad for being anxious for the fate of a friend. Logan is a fine man, and it would be a Godsend if you could help him, Major Lee."

"So you're in Orvie's plot, too!" said the Major, smiling.

"I'd not hesitate to offer myself," was the reply, "but I've no' the time. I've only a private pilot's license, besides. Your going, Major, would mean everything to Logan. He's been putting his faith in

what he would earn this summer. He spent all his economies on buying that big Bellanca."

"I know, I know — " but there was a doubtful note in his voice.

"You see, Father," put in Orvie, speaking more quietly and reasonably, "it's this way. There are two city hunters up at the camp now: Mr. Merrill, who shot Mr. Logan by accident, and his friend, Mr. Porrit, a broker from Cleveland. It's likely that, after this accident, they'll want to come back. In four days, too, Mr. Logan had planned to go to St. Louis to pick up two hunters for the other camp. With a private pilot's license, I can't carry passengers; it's against the law. And if one of the Lac du Bonnet's pilots takes the *Dan'l Boone,* he'll know just where our camp is, and it won't be private any more."

"Now you're beginning to talk more sensibly! I see. Personally, I'm willing enough to go. There's nothing I wouldn't do for Matt Logan, but — "

"Is it your promise to Mother, Dad?"

"Well, yes; partly."

"Oh, I can get her to understand! Let me talk to her, Father!"

"You think you can wheedle her, do you? That remains to be seen."

He turned to the visitor, with Southern courtliness.

"If Mr. MacTavish will do me the honor to come in?"

Seated hospitably on the porch, with a good cigar, the Scotchman nodded kindly to Orvie.

"There, Lad," he said, "go and talk to your mother. I wish you a bonny success, for it would be a pity not to finish what you've begun so well."

"You don't mind if we leave you a minute?"

"Why, Major!"

Rather to her husband's surprise, Mrs. Lee made little objection to the proposed plan, only saying in her rather abrupt fashion:

"If flying is for anything really useful and to be of help to some one, of course I shall not stand in the way. It is gallivanting in the air for nothing that seems to me so silly!"

This willingness to let her husband go, might, perhaps, have been more gracefully put, but Mrs. Lee had a deep aversion to flying and lived in constant fear of accidents. To see Orvie's passionate interest in aviation had been a real cross to her, and she nourished an earnest intention to turn her son towards the side of aeronautical engineering, which would keep him on the ground instead of in the air. She was shrewd enough to see that she would only hurt

her own future plans by opposing her husband at this time; moreover, for some dim reason of her own — queerly enough, most women seem to have it — she thought seaplanes much safer than landplanes.

Over the hastily prepared but substantial dinner, Duncan MacTavish's tactful conversation went far to soothe Mrs. Lee's fears. He was a canny Scotchman, commercial and practical to his finger-tips, and his whole talk of aviation was as of a business as firmly established as the railroads. His matter-of-fact manner visualized flying as something actually accomplished, with planes running on regular schedules in a sober and common-sense way. Major Lee's interest in aviation was always along the line of new models, new inventions, new instruments, and record-breaking feats, and this had only deepened his wife's beliefs that flying was still in the experimental stage.

After dinner, Major Lee having hunted up his flying togs, his papers, and everything necessary, Mrs. Lee actually came out willingly to see them off. MacTavish had done more to reconcile her to aviation in a couple of hours than her husband had been able to do in ten years.

The major himself took the controls, with MacTavish's consent, in order to fulfil the requirements of the Department of Commerce, which insists that

a pilot must have a certain number of hours of actual flight within 60 days prior to piloting passengers.

Arriving at MacTavish's home, again, just before sundown, Major Lee took the pony which the boy had ridden over that morning, and hurried to the infirmary, anxious to see his old flying pal. Orvie was pressed by Duncan MacTavish to stay to supper, for the Scotchman wanted to hear all the details of the shooting, and the boy was driven over, later, under the moonlight, in an old-fashioned buggy.

The doctor would make no more encouraging statement about Logan other than to say that his patient was not any worse. In order that news of the patient's condition might be received at Lake Noocumpook Camp, the Lac du Bonnet radio operator agreed to send out a message, at 7:30 sharp, every morning.

"Be on the job to receive!" he said, decisively, "for it's not usually permitted to send out private messages."

Next morning, with Orvie at the controls — he knew the way thoroughly, now — the *Dan'l Boone* rose from the Lac du Bonnet and winged her way steadily back over the North Woods to Lake Noocumpook. Much to the boy's satisfaction, he made a perfect landing on the little lake, satisfying even the critical requirements of his father.

Merrill hurried out in the canoe.

"He's going to get well!" shouted Orvie, knowing what the hunter's first question would be.

Merrill's reply expressed the profoundness of his relief.

Yet, even so, nothing would tempt him to pick up his rifle again, and when, two days later, the doctor's report was a little less favorable, the Cleveland man insisted on going to Lac du Bonnet with Major Lee and Orvie, the Major as pilot. The other hunter, Porrit, remained at the camp with Pete. He had never had better sport in his life.

Fortunately, Logan had told Orvie all his plans in detail, and, in a loose-leaf file at the camp, there was all the correspondence concerning the summer's arrangements. Major Lee quietly assumed control of everything and engaged an old-time Hudson Bay Company fur-factor to act as foreman at the camp, for Pete was necessarily away most of the day, and the Major knew nothing about running a hunting camp.

In ten days, Logan was pronounced out of danger, but the doctor forbade him to undertake any exertion. The boy and his father carried on the work, and, when there were no passengers aboard, Orvie did most of the flying. Keeping as closely to his

wife's wishes as he could, Major Lee went up only when there was actual need, and, as he was an ardent fisherman, this stay at Lake Noocumpook gave him a welcome holiday.

The transport of provisions and other supplies was left to Orvie, so that, with these trips and with his mechanical work, the boy was tremendously busy. In the first month's duties, he only got a chance for a full day in the woods four times.

It was on one of these trips, bringing back supplies, that Orvie saw a suspicious cloud in the distance. He had taken off with a high wind and a clear sky. The cloud was too black for a storm cloud, and not dense enough to indicate a squall. A few minutes' further flying, and Orvie saw that it was the smoke of a forest fire.

Immediately the boy remembered the numerous accounts he had read of the splendid service rendered by airmen to the U. S. Forest Service in times of danger. Though he was in Canada, the idea came to Orvie that he might be of service to the Dominion Government. He could, at least, fly over the region, locate the exact positions where the flames were fiercest, determine the compass direction in which they were travelling, and then, dropping back to Lac du Bonnet, he could give the detailed information there.

The wireless station could get the news immediately to District Forest Headquarters, and the information might be helpful. Even if it were private forest ground — as was most likely — it would be to the national interest to try to stop the blaze.

Airplanes have been used with very great effect in the U. S. Forest Service, especially covering those parts of the National Forests where trails have not yet been cut, or where, by reason of a ravine or a wide river, it is necessary to make a long detour in order to find out the points of greatest danger. An airplane can skim over the forest and return to a landing base in an hour or so, with a plotted map showing exactly the places where the fire is burning fiercest, a matter not always easily to be determined from the ground, especially if the wind is blowing toward the observer and hiding his view in clouds of rolling smoke. The airplane observer, flying above the smoke — especially if there be a high wind — can see the line of fire with perfect definition.

But it is not only in matters of danger, such as forest fires, that the airplane has proved of enormous benefit. A party under Lieut. Wyatt, of the U. S. Navy, with two Loening amphibians, undertook the photographic mapping of the timber and water-power possibilities of a section of Alaska, for the U. S.

Forest Service and the U. S. Geological Survey combined. They took over 40,000 aerial photographs, with an accuracy and certainty which gave the Forest Service more detailed information in a single summer than twenty years' work with large field-crews could have done.

Orvie had read every line of matter dealing with Forest Service surveying and fire-observation by airplane, and the sight of this forest fire in the distance was a personal chance too good to be overlooked. The day was young, his fuel-tanks were nearly full, and he knew that both his father and Logan would back him up for time spent in a detour which might prove useful.

He banked, turned to the right, and climbed, in order to make a circling sweep over the whole of the threatened area.

"It's bigger than I thought!" the boy muttered, as he came closer and saw that the fire had spread, first, in a wide "V" and was roaring ahead with great velocity.

He took still more altitude, prudently, figuring that the air above the heated area might be bumpy.

"Whew! It's a whale of a fire!"

Carefully he spiralled to a lower altitude to see more clearly the direction of the fire, and, as he passed

above a whirling cloud of smoke, and peered through a gap to the ground below, suddenly his hands clenched on the controls.

"Isn't that a settlement!"

He dropped lower.

No doubt of it!

Right between the converging lines of the "V" of fire was a small lumbering town or settlement, not very big, but containing, probably, a couple of hundred persons.

He flew on, watching the ground rather than what was ahead.

Suddenly a blast of heated air, furnace hot, and swirling upwards from the fire like an eruptive column, hit the plane from below.

The Bellanca rocked badly.

Instinctively, Orvie pulled the joy-stick back, to climb, but, startled by the fiery gust, he jerked it back too fast.

The plane nosed up, stalled, and broke into a tail-spin!

Right over the fire!

Well was it for Orvie that he knew something of air tactics, though he had not learned aerobatics yet. But this, at least, he knew! He shut off the engines to make the plane nose-heavy.

Down she dropped toward the flames — and Orvie had not much altitude!

But, with the engines stopped, she levelled as she dropped, and the moment she came near enough to an even keel, the boy gave her the gun. The engines roared, and, wisely daring, Orvie nosed her down a little for added speed, shot through the spark-filled smoke, and was across the line of fire and out of danger in a second.

But it had been a narrow escape.

"So much for being an idiot!" he growled to himself.

With full speed and slight diving impetus, besides, he started to climb, then banked, turned, and, circling well out of the zone of smoke, came down between the lines of fire on a slow dive, banked and turned with great care and swooped lower, until he was circling not more than a hundred feet above the tree-tops.

The fire was still some distance away, but racing on.

The people of the settlement ran out of their shacks to look at the big tri-motor Bellanca circling above them. It was clear that the airplane was bringing them some message, and they made signs to Orvie to come down and land. Not a person in the

place knew the difference between a pontoon and landing gear, and they seemed to suppose that a big seaplane could come straight down into a small clearing like a stone and shoot up again like a rocket.

Dropping as low as he could — he did not dare come too far, for his one experience of swirling heated air had warned him to be cautious — Orvie shut off his motors for a minute and shouted. But his voice did not carry, and all that he could hear from the ground was a confused sound, though every one was shouting.

What could he do?

He could not land, and, even if he could have done so, he could not have taken off more than three or four persons at most, thus rendering but little service.

Up the boy went again, this time circling fairly high to get a bird's-eye view of the fire and to study the lie of the land. On the left leg of the "V," a shift of wind or a ground current, seizing upon some heavy timber and brush along a flat, was sending a tongue of fire at an angle which threatened to close the "V." On the right leg, the timber was sparser, and rougher country stopped the progress of the fire a little. The danger was that the little town would be entirely surrounded.

Back he cruised over the settlement and carefully noted the compass bearings.

He had his plan — though whether it would work or not, he had no idea.

With his jack-knife — he did not wait to get at the tools — he unscrewed the smaller of the two compasses from the instrument-board. He broke the point of his knife, twice, in doing it, but that was no great matter. Then he took out his handkerchief. Fortunately, it was a fairly big one, even if a bit grimy. From the emergency tool-kit he took some insulation wire, and cut off four short lengths and four a little longer. These he twisted into hooks, and stuck each of the shorter hooks into the corners of his handkerchief, the longer ones into the middle of the sides.

This was not done without difficulty and a good deal of danger. Circling, thus, between the two lines of fire, the air was bumpy and uncertain, and the plain seemed like a living thing — little at her ease. The controls needed constant attention, light touches, but necessary. It took tricky piloting. With a plane less stable than a Bellanca, it would have been even more perilous.

The inevitable aviator's pad and pencil was the next thing, and Orvie scribbled hastily:

"Fire creeping around you fast. No time to lose! Everybody leave the town. Go NNE half E. Keep compass direction exactly. If you go West of that, you'll get caught. Hurry!"

He wrapped this note around the compass, wrapped a rag around it and knotted it tightly, stuck the other ends of his wire hooks into the rag — testing each for length — and got ready to drop this tiny improvised parachute.

To be sure of having plenty of speed to lift over the trees, he circled to the lee of the town, and came down on a steep glide toward the clearing, coming to within fifty feet of the ground. Allowing for speed, he let the message drop.

At first it looked as though the whole thing would drop sideways, but the little handkerchief parachute took the air, and though it wobbled downwards in clumsy fashion, yet the spread was enough to check the fall of the compass. Orvie had been afraid that if he threw the instrument down, simply, with a note, the compass needle would be jolted off its bearings.

At the speed he was going, the boy could not follow the drop and he had not time, for he was driving straight for the fire. He did not dare to turn, for he was headed straight for the point of the "V". But he had terrific speed, and he put the *Dan'l Boone*

at a slight climb with all three motors at full throttle.

She roared over the line of fire like a meteor.

Circling back, Orvie saw the parachute fluttering down. A man dashed forward, caught it, read the note, looked up and waved his hat as the boy came speeding overhead.

The message had been understood.

From up in the air, Orvie could see the people running from house to house. They had already been alarmed, but, owing to an intervening ridge, they had seen the fire only on one side and had not realized that they were being surrounded.

Over their heads, Orvie flew backwards and forwards in a straight line in the direction where the fugitives ought to go, and his heart beat with satisfaction when he saw the people trooping out, one man with the compass at the head, and keeping the line which he had indicated.

The fugitives had quite a distance to go to reach the ridge, and the fire was now roaring towards them. As the fleeing men and women got on the slopes, they saw, for the first time, the fire behind. There was no further need to urge hurry. The flames were only about three miles behind them — and a forest fire goes like a race-horse — when they topped the ridge.

They were not yet safe, but the worst of the danger was past, for a top-fire, roaring thirty miles an hour up a hill, is forced to drop and become a ground-fire, creeping not more than a mile or two an hour down a slope.

Circling a second time, Orvie dropped another message, weighted to a can of sardines — part of his supplies:

"Bear NE now. I can see a bridge over a river, and a mile or two ahead I can see a trail."

The message was picked up, and a faint sound of shouting came to the boy's ears.

But the left-hand fire was racing fast, though the fugitives were entirely unaware of its speed and direction, and Orvie, watching overhead, began to fear that, after all, his warning might be too late. It was of no use to drop any further messages bidding them hurry, for the settlers were evidently making what haste they could.

They struck the trail, however, and from there on progress was faster.

Orvie, from above, saw all in breathless suspense. He, and he alone, could see the agonized race against the demon of fire; he, and he alone, had the thrill of being able accurately to measure the danger.

But the fugitives reached the bridge with fully a quarter of an hour to spare and settled down on the farther bank to rest. A good road led onwards, and, while it was always possible that a big fire might jump the river at some point, it would not do so all along the line, and it could easily be stopped.

He dropped one last message:

"All safe probably, but don't halt too long. Will go to Lac du Bonnet and summon help. Plane *Dan'l Boone,* Orvie Lee, Pilot."

And the big Bellanca winged its way onwards, high above the flames, its youthful pilot happy in the knowledge that he had saved two hundred lives.

Courtesy of U. S. Air Services.

BOEING AIR TRANSPORT MAIL, PASSENGER, AND EXPRESS PLANE FLYING OVER THE RUBY MOUNTAINS IN NEVADA.

Courtesy of Aero Digest.

THE UNITED STATES NAVY'S NEW AIRPLANE CARRIER
SARATOGA.

CHAPTER X

AEROBATICS

In air-work nowadays, in commercial work especially, adventures come but rarely, and flying is much more a matter of efficiency than of risk. A first-class pilot may handle a plane for years, and never have any real excitement, other than the nature of his work.

As mechanic, and often as pilot on trips for supplies, Orvie handled the *Dan'l Boone* all the rest of the summer without a single incident of particular interest, except, perhaps, the killing of his first moose, and that had nothing to do with flying.

Logan soon took a turn for the better, and he was out of the infirmary before three weeks were over. The hunting season, which was protracted until late in the autumn, passed without a hitch. When the camp broke up and the last flight had been made, Logan said, as he handed the boy a substantial check for his summer's work:

"If you want the same job next year, it's yours!"

But Orvie's satisfaction at his first earned money paled before the news which was awaiting him at home.

After the first flush of mutual greetings was over, his father said to him, quietly,

"There's an important letter here for you, Son."

"For me? Who sent it?"

"The Grand Trunk Lumber Corporation."

"I never heard of them."

"Well, here's their letter!"

And Orvie read:

"MR. ORVIE LEE,

"Dear Sir:

"The full details of your heroic action in braving the flames of a forest fire on July 11th. last, and by dropping of timely mesages from the airplane *Dan'l Boone,* saving the lives of two hundred Canadian residents of Pipestone Creek, has been brought by us to the attention of the Dominion Government.

"For our part, and on behalf of our Corporation, I am instructed to inform you that, as a slight token of our appreciation, we beg to have the pleasure of presenting to you an airplane, fully equipped, of whatever make and size you may prefer. We should wish it to be named *Pipestone,* in memory of your act of rescue, and we trust to have the honour of receiving shortly your acceptance of our offer. With every expression of our highest esteem,

"Believe me

..... PRESIDENT."

"Father! A plane of my own!"

Major Lee's eyes gleamed with a pleasure not less intense than that of the boy's.

From his pocket he took a small box.

"This is for you, too," he said.

Orvie opened it.

It contained a silver medal. On one side was engraved a tree, in flames, with an airplane above it, and, around, the date "July 11, 1928"; on the other side was engraved:

"From the grateful residents of Pipestone Creek to Orvie Lee, Aviator."

"But it's too much!" the boy cried.

"No," said his father. "I can see just how much those lumbermen wanted to do it. There's no doubt that you did save their lives. Treasure it, my boy, for a thing like that doesn't happen twice in any man's lifetime."

And his mother added, quietly,

"It was Providence that set you to want to learn to fly."

From that day on, Mrs. Lee was heart and soul in her son's career.

When he returned to the Flying School, a few weeks later, Orvie was conscious that his forest-fire feat was known, though none of the instructors men-

tioned it. Some of his fellow-students begged for details, but Orvie pointed out that he had only done what any other flyer would have done in his place.

The boy soon slipped back into the routine of the school, completing the work needed to give him the license of "airplane mechanic" in addition to the "engine mechanic" which he already had.

But it was when the head of the school, a former Professor of Aeronautical Engineering, offered to give him a few elementary ideas of Aerodynamics that Orvie realized what an enormous amount there was to learn. For the first time he saw into the intricacies of aircraft engineering and the magnitude of the problems involved.

"It's easy for you, now," said Mr. Zill, "because you can get books and learn the results of the last twenty years' experience. The airplane of 1929 is as different from the craft flown in the World War as that was from the Wright's first power-driven glider. Never has the world seen so powerful a concentration on any subject as engineering has given to the airplane between 1919 and 1929; never has so great an advance been made in so short a time."

"Do you regard the present airplane as having reached its final form, Mr. Zill?"

"As an airplane of the present type, yes. Not on

any empirical grounds of efficiency, but viewed as a mechanical and aerodynamical problem. There's no guesswork in a modern plane. Refinements will be made — are being made all the time — but the main design has become stable and the principles are accurately known."

"How about the helicopter, sir?"

"That's a different story. A helicopter works on the principle of vertical propeller traction, and the aerodynamical problems run along quite a different branch. No efficient design has as yet been presented, but he would be a daring man — and a foolish one — who declared that helicopters have no future. Helicopter principles can be added to airplanes — the Auto-Giro of La Cierva has an indirect relation to the principles, though it is used as a plane."

"What is the principle of the Auto-Giro, sir? I've never seen one."

"None of the later models has been seen in America. The Auto-Giro has flown from Paris to Brussels, and orders have been placed both by the French and English governments — for experimental purpose, I admit — so that this machine is to be taken seriously.

"In a normal-type fuselage, fitted with the usual engine and propeller, the wings are replaced by four

horizontal planes mounted at right angles to each other on a vertical pillar just in front of the centre of gravity. They are free to revolve. As soon as the machine moves forward by the traction of the propeller, these planes revolve, and, when they have attained sufficient speed, bear the weight of the machine. Although revolving, they act as 'wings' or planes, and hence the Auto-Giro is an airplane, not a helicopter, for the engine-power is in no sense directed to the horizontal revolving planes. Later models have a small auxiliary motor, but that is not to create lift. Its great advantage is that its climb is much steeper than an ordinary plane, it can descend almost vertically at slow speed, and can — and has — been made to come down on a sheet spread on the ground without running off the sheet. But, like all new inventions, each model shows a distinct improvement on the last. There are special devices for ailerons and rudder. It seems to have a future.

"The Hill Tailless Monoplane, with wing tips swept far backwards and no rudder or elevator in the usual sense of the word, also has shown itself fully capable of flight. So far, it has not shown any great advantage over normal airplane design — but that is not to say that it may not be developed."

"And the ornithopter?"

"I should be more ready to declare that to be based on a wrong principle."

"But birds fly upwards by flapping their wings, sir!"

"They don't!"

"What, sir?"

"They do not!" answered the professor, emphatically. "It is not the flapping of the wing which lifts a bird. The history of that error is the history of the discovery of true flight-principles.

"Leonardo da Vinci, the first great pioneer of aviation, wrote in the Sixteenth Century: 'A bird is an instrument working in accordance with mathematical law, which instrument it is within the capacity of man to reproduce'. That statement is, to this day, the basis of all aeronautical engineering. He also urged 'a study of winds' or air resistance, as a prime essential. But his mechanical wing failed, because he had mistaken the principle of a bird's flight.

"Bishop Wilkins was the next to deal with the flapping-wing idea. A scientific thinker, he raised the doubt that human muscular power could ever raise a man's weight from the earth, but he foresaw one great aviation truth when he said, 'If a flying chariot can be raised and rapidity attained, it will be easier to keep it in the air than to get it there.'

"The dreamers who hoped to fly by attaching wings to their arms next got a sore blow when Borelli pointed out that one-sixth of the weight of a bird's body was given to wing-muscles, and less than the hundredth part of a man's. 'Therefore', he concluded, 'wing-flapping by the contraction of muscles cannot give out enough power to carry up the heavy body of a man.' But he did not find out, either, the mistaken principle on which his predecessors had worked.

"Paucton returned to one of Leonardo's notions and constructed a helicopter. His reasoning was sound and his helicopters flew; but they did not fly on their own power, and though a helicopter has been made which will lift a man, it is beyond measure clumsy.

"To Sir George Cayley must be given the credit for showing the fundamental error of the ornithopter principle and revealing the principle of the modern airplane. He set forward clearly, for the first time, that the flapping of a bird's wing is not for the purpose of sending it upward, but onward, the upward movement being the resistance of the air under the wings, exactly as in a modern airplane.

"No bird can fly straight upward by wing-flapping.

"Henson and Stringfellow constructed an aero-

plane, driven by steam, which flew, and, from that time onward, the history of development is well known. Lilienthal, Pilcher, and Chanute developed the principles of airplane structure in their gliders, Langley developed the principles of aerodynamics, and final success came through the light explosive engine.

"With the victory of the Wright Brothers at Kill Devil Hill, N. C., when first a power-driven airplane carried a man in flight, all interest in ornithopters ceased and the true airplane took the centre of the stage. But Lilienthal, in Germany; Pilcher, in England; and the clever-fingered French sailor, Le Bris, who found out the principles of flight, for himself, by studying the wing of a dead albatross, and made a powerful glider which flew for 200 yards with two men; all would have flown with their gliders if the explosive engine had been available then. One must not forget to give credit, too, to Blériot, who flew across the English Channel in a very primitive type of monoplane. You remember his reply when some one asked him what was the use of it?

" 'What is the use of a baby?' answered Blériot."

Orvie laughed.

"The same thing happened not so long ago," the Professor continued. "When 'looping the loop' was

only a 'circus stunt', a man asked Latham what was the use of such tricks.

" 'You'll fall, one of these days!' said the pessimist.

" 'How many times does a baby fall when learning to walk?' retorted Latham."

"I'm to start 'stunt-flying' next week," commented Orvie.

"I don't like that word," said the Professor, frowning. "There isn't any such thing. Call it 'Aerobatics', if you like. But it's as necessary a part of an airman's training as it is to know the difference between a joy-stick and a rudder-bar."

"I don't quite see why, Mr. Zill."

"I'll explain. What's the principal difference between progression in the air, and on land or water?"

"Land or sea travel," said the boy slowly, picking his words, "is in two dimensions; flying is in three dimensions."

"Right. Therefore it is necessary to know the opportunities and difficulties of that third dimension. The sole danger of flying is a sudden drop, either because of some error on the part of the pilot — that's the cause of so many accidents to learners — or to structural weakness of the plane, and that's rare, nowadays.

"Now, let us consider what is the difference be-

tween flying and dropping. How would you put it, Orvie? Think before you answer."

"In flying, the machine is in control; in dropping, it isn't."

"I want a better answer than that. Put it aerodynamically."

"Oh, I see what you mean, sir. Flying means that the plane is offering a sufficient resistance to the air to keep it supported; dropping means that the surfaces of resistance — wings, tail, and so forth — aren't giving the support."

"Now you're getting it. One more thing. Can a plane get into a position in the air from which a good pilot cannot cause it to recover?"

"I suppose not," said the boy, but there was a doubtful note in his voice.

"You mustn't have any doubt of it!" corrected the other, sharply. "So long as you're high enough, anywhere above 500 feet, say, there isn't a single thing a plane can possibly do from which a pilot can't bring her on an even keel. Chamberlin's famous recovery after the three-mile drop caused by Levine in the first America-to-Germany flight is a classical case.

"Therefore, my boy, looping the loop, spinning, rolling, and doing such things as the 'Immelman turn', the 'cart-wheel' and the 'falling leaf' are not

circus tricks. They are doing, voluntarily, what may happen to you involuntarily. When you get to know — almost instinctively — what ought to be done in a voluntary spin or drop, you'll have knowledge and confidence to do it any time that there is urgent need."

This little talk made Orvie all the more eager to have a chance to do aerobatics, and, the next time he went up with a Flying Instructor, he asked about it.

"If the Chief thinks you're ready," said the Instructor, "I'll give you a few ideas about side-slipping. That's the commonest happening to a beginner. We'll begin high up, so as to give you plenty of room. What does the altimeter read?"

"Nine hundred feet."

"That's enough. Now, suppose you've got to make a forced landing in a small field. If you go down in the ordinary way, your landing run may be too long and you'll run your nose against a wall — good-bye, Plane! For a quick descent with a minimum forward speed, the side-slip is useful."

"How do I start it?"

"Just as if you were a greenhorn and made too steep a bank on a slow turn. Slip against the wind, remember. If you slip with the wind, you add windspeed to the sideways speed of the plane, and that'll

make you land with a sideways momentum and likely wipe off your landing gear. All set? Bank, then! That's the idea! Now we're slipping. Feel the side-draught?"

"Rather!" said Orvie, not very easy in his mind. "I suppose I ought to keep the nose down?"

"Certainly, to keep speed. Half-way between the normal gliding point and the horizon. That's about right."

"Aren't we getting too far down?" queried the boy, nervously.

"Not a bit. Straighten her out, if you like. Push the stick towards the high side — not too jerkily!"

Almost like magic the plane came level and shot forward to a glide, and Orvie opened up the motor to gain flying speed.

"See how easy it is? Try again! Come within sixty feet of the ground, this time."

Orvie repeated the performance, with more confidence. The quick recovery of the plane had surprised him.

"Do it half a dozen times or so. By the time you're ready for lunch, you won't be any more afraid of a side-slip than I am."

The prophecy was true. After a few maneuvers, the boy had acquired perfect confidence.

"Now, for the last time," said the old pilot, "make a side-slip landing. Here's a small field below us. It's not more than a hundred yards across, so, if you came down in the ordinary way, you'd likely skate across the field and smash something. If you side-slip down, while your dropping momentum will be great, your forward speed will be low. Landing then, you won't run far. Try it. Level when your lower wing-tip is about fifteen feet from the ground. Don't be afraid; the plane will level all the quicker because there's a small extra cushioning support on the air close to the ground. Ready? Off with you! Bank! That's right!"

The plane side-slipped and hurtled downward.

"Keep her nose where I said! Ready to level? Not too soon! Now! That's the idea. Drop her nose a little. Level a trifle. Lift her nose a hair as the wheels touch. Level. Fine!"

The plane taxied to a standstill in about thirty yards.

"You see, Orvie, once you can thoroughly control a side-slip landing, you can use the smallest field. It's imperative, sometimes. Now, taxi back, take off, and we'll go home for lunch. Nicely done!"

Two days later, Orvie was given his first lesson in looping the loop.

"What's your altitude?"

"Three thousand, five hundred."

"Plenty high enough. Now remember, while looping the loop looks difficult, from the ground, it's about the easiest trick there is. We're flying level now, aren't we?"

"Yes, sir."

"Keep her level laterally. Now, push forward the stick and dive till you add about twenty-five per cent to the speed. Keep your rudder straight — that's important. That's about fast enough. Keep straight, and keep level. Now, pull the stick back. . . .

"Easy! Easy! You'll stall! Throttle down!"

The engine being cut off, the plane became nose-heavy and came down again to a gliding position.

"Give her gas, now."

"What did I do wrong?" queried Orvie.

"You tried to collapse your wings," said the Instructor grimly. "If you'd been flying with a 'bus' of a few years ago, we'd all have been in a heap on the ground — what would be left of us! I didn't tell you to yank the stick back like a railroad switch! You pulled so suddenly as to give the planes an enormous angle of incidence. The air-flow over the top made a whirlwind there, and the underside of the planes got

a terrific blow. Don't ever forget that, when you're going at high speed, the air is every bit as solid as an ocean wave. A weakly built plane would have collapsed. I thought you were a pilot, already!"

Orvie colored to the roots of his hair.

"All right," said the Instructor, more kindly, "everybody's got to learn some time. But a joy-stick needs a light hand, not a blacksmith's fist. Try it again. Climb for altitude, and then dive for speed. That's better. Pull back steadily. . . . Now we're vertical. . . . Push the stick sideways towards the lowest wing-tip. . . . Right. . . . Now we're at the top. Throttle down the engine. . . . We're coming over. . . . Put the stick just a little back of neutral. . . . Keep straight and level. . . . There she comes, pull her quietly, quietly mind! out of the dive. . . . Normal. . . . Open up the engine again. . . . There's your first loop!"

"But," said the boy, surprised, "I didn't feel a bit like falling out when we were upside down! On the contrary, I felt as if I were jammed into my seat. Centrifugal force, I suppose?"

"Exactly. And that shows that your turn was too tight. If the turn is too slow, you'll have the feeling of falling out. The proper loop is when you keep your seat without any feeling of being pressed down

or of tumbling out. That means that the various forces are evenly balanced. You can see for yourself that if it puts no strain on you, it won't on the plane."

"But I don't see why I must throttle down at the top of the loop."

"You don't need the engine, once the top is reached. Gravity will give you all the speed you need. Engine, after the top, would give you too much speed and enlarge one side of the loop; what's more, your dive would be too fast and recovery slower. Try again."

But in the middle of it, Orvie side-slipped. But he recovered easily enough, for there was plenty of altitude.

"What did I do wrong then?" he queried.

"Didn't keep your rudder straight. Even a light turn gives the outside wing more pressure and tilts you sideways. That's about all the mistakes you're likely to make, unless you throttle your engine before you reach the top. Don't do that, for it makes a tail-slide, and while it's not difficult to recover from a tail-slide, it puts a severe strain on the machine. Some flimsy makes won't stand it. Never throttle till upside down."

Orvie was surprised to see how quickly he caught

the trick, and, that very same morning, looped several times, thus achieving his first test of aerobatics.

"Spinning" gave him more trouble, not because the recovery was any more difficult, but it took him three days to get thoroughly accustomed to the giddiness of the rotation. That fear once overcome, it was easy enough to remember to centralize the rudder and push the stick forward to make a straight dive, after which levelling out was normal. The "half-roll" did not prove difficult, but for some reason or other, the "full roll" worried him a good deal, and he never got to the finish shown by his Instructor, who made four complete full rolls without loss of altitude. It takes an expert airman to do it.

The "Immelman turn", used mainly in warfare to enable the pursued to twist around and above the pursuer, was the next feat learned. Then came the "falling leaf", of no value except for training in all possible positions, and, lastly, the "cart-wheel".

As Orvie was spending most of his time on the mechanical and engineering end, this flying instruction only came occasionally, but, well before the end of the winter, he was ready to try any evolution in the air. He could consider himself a finished and expert pilot for any form of fair-weather flying, but, as his Instructor warned him, a full knowledge of the

use of instruments was needed for blind-flying, night-flying, and all the risks of bad weather. Only his age forbade his taking the higher pilot licenses. The following year he counted on passing all the examinations that the Department of Commerce would require.

CHAPTER XI

WHEN FLOODS RAGE

The following summer found Orvie back again with Matt Logan at Lake Noocumpook, and the hunting season passed without mishap or accident. The boy had proved his mettle, and, as many of the hunters who had been to the camp the previous year returned, all were the boy's friends.

He did not return to the Flying School, the winter following, having secured both the mechanical licenses he sought, but entered a Technical College for a special engineering course. This was partly at his mother's request, and partly because Major Lee wanted the boy to have as full a training as possible before his eighteenth birthday, when he would be permitted to secure full pilot rights and to enter the flying world professionally.

But, one April morning, opening his daily newspaper, Orvie read of high water in the Upper Ohio and Upper Missouri, of continual rainfall, and of fears that, if the heavy rains continued, there might

be a repetition of the disastrous Mississippi flood of 1927, for flood prevention measures had partaken more of discussion than of action.

Could not he do something? Surely the airplane could afford some means of rescue!

On sudden impulse, Orvie darted off for the nearest telegraph office, picked up a blank, and wrote:

PRESIDENT,

GRAND TRUNK LUMBER CORPORATION, TORONTO:

DOES YOUR OFFER OF "PIPESTONE" AIRPLANE STILL HOLD GOOD? CHANCE FOR FLOOD RESCUE WORK PROBABLE.

ORVIE LEE.

Promptly the answer came back:

ORVIE LEE, AVIATOR:

GET BIGGEST PLANE YOU CAN FIND. SEND US THE BILL. SUGGEST CURTISS-SIKORSKY AMPHIBIAN.

The boy whistled. This was one of the most expensive planes on the market, with an eight-passenger cabin.

He telegraphed back:

SIKORSKY ENORMOUSLY COSTLY.

ORVIE LEE.

The reply came promptly:

ONE HUMAN LIFE WORTH MORE THAN ANY PLANE. YOU SAVED TWO HUNDRED, ALREADY. BUY QUICK. GET TO FLOOD WORK.

Orvie knew that this plane had done some wonderful work, was used by the Western Air Express, and was especially powerful in the water. Very solidly built, powered with two 410 h.p. Pratt and Whitney "Wasp" engines, the Amphibian had been approved by U. S. Army and Navy experts and was capable of long sustained flight; it was able, moreover, to keep aloft on one motor, with full load, should either engine happen to get out of running order.

After a further exchange of telegrams with his father, the boy took the first train to Washington to visit the Aeronautics Branch of the Department of Commerce, taking with him the letters and telegrams he had received, and, besides, a personal letter which the head of the Flying School had given him, certifying that he was able to meet all requirements for a full Transport Pilot's license.

"It's a little irregular," said the head of the bureau to whom he made application next morning, "because even an Industrial Pilot's license cannot be granted to any one under eighteen years of age."

"I'm in my eighteenth year, sir."

The official smiled.

"The wording of the law is definite! But you say that you want to use this airplane for rescue work down in the flood districts?"

"Yes, sir. That was my idea."

"Well, you wouldn't be very likely to ask a refugee to pay for being rescued, would you?"

"What an idea, sir!"

"So, in a way," the official went on, "your private pilot's license would allow you to carry any one you liked, so long as you didn't do it 'for hire or reward' — that's the wording of the section. But, in view of the fact that you can show more than two hundred hours of solo flying, that you've done all the emergency maneuvers, and that your purpose is a philanthropic one, I can waive the age qualification to the extent of giving you a temporary 'limited commercial' pilot's license. Show me your log-book at the end of the month, and I'll extend it for three months, if all goes well. After that, we'll see."

"Then, sir," asked the boy, "do you think I am justified in accepting the Lumber Company's offer?"

"It's because of that offer and because of your record in that Pipestone affair that I'm willing to stretch a point as to the license. I shouldn't be easy in my mind if I refused any air help to the

flooded districts. Things are not bad there, yet, but every day shows them worse, and the Weather Reports are not encouraging. The sooner you get there, in reason, the better. Perhaps it may help you if I call up the Curtiss people on the long-distance 'phone."

"Do you think that's the best plane for me, sir?"

The official shrugged his shoulders.

"It would hardly do for me, in my position, to express any preference or give any publicity," he said. "The Loening Amphibians have done some startlingly good work, the Vought people have a new two-purpose plane that stands up well, the Boeing Flying Boat has a mighty good name behind it, the Fairchild has a combined pontoon and ski plane for water, snow, or ice, and pretty much the same endorsement might be given to anything turned out by the Martin, Mahoney, Wright, Douglas, or any other of the really first-class American aircraft companies. But if any one cares to offer me a Sikorsky Amphibian for nothing, I'm not going to say 'No'!"

Arriving at the Curtiss factories, Orvie was not surprised to find that he was expected.

"So you're the youngster the Department of Commerce called up about!" said the head of the flying-field. "Oh, I'd heard all about you, before. I re-

member the Pipestone Creek fire; it was all written up in the *Toronto Globe.*"

"Was it? I never saw it!"

"Just as good for you, maybe. Might have made you too cocky. Well, I hear we're to turn over to you one of our newest model Amphibians, just like that! When do you want to go? Right off the bat, I suppose? I would have, at your age."

"I'd like to go up in one, first, with one of your pilots at the controls, if I might."

"What for?"

"To get the feel of her."

"I was told that you could fly a barn-door, if it had a motor tied on with string."

Orvie grinned.

"So I will — if some one else will take it up the first thousand feet! But I've never flown anything bigger than the tri-motor Bellanca, and I want to be sure that I know."

"Couldn't you fly her off to-day?" queried the expert, anxious to get the boy's real feelings.

"I could, sir, I think, but I'm not going to. I'd like to have a day in the shops — though I know a 'Wasp' pretty well, and another day in flying tests. Of course, if the floods get worse quickly, I'd like to go at once."

The chief of the flying-field nodded with satisfaction. Evidently the boy knew his business.

"I'll take you up, myself," he announced.

Orvie gave a gasp of amazement as the Amphibian was rolled out. A more magnificent aircraft he had never seen.

"She is a beauty, isn't she!" was the chief's comment as he saw the boy's admiration. "And she acts as well as she looks. We'll take off on land and drop in the water," he continued. "This is a new model. It was built for a big copper magnate, but he's in Europe, now, and we'll have a sister craft ready before he comes back."

"But that's a craft for a millionaire!"

"To the last notch."

"And she's going to be mine?"

"She is yours, right now. At least, to all intents and purposes. Of course, you being a minor, Major Lee will have to sign. I wired to him last night. And I've no fear about the Grand Trunk Lumber Company's check. I wired them, too. Hop in! I'll take the controls for the first burst, since you want me to."

The big Amphibian lumbered along the runway a little heavily as compared with the *Dan'l Boone,* but she had powerful shock absorbers and the jolting was

not great. Her "Wasps" developed enormous power and she lifted with a shorter run than the boy had expected, circling round the field at tremendous speed with her engines at half-throttle, and came down on the water firmly, but lightly.

When she came to a standstill, the two changed places. The expert gave a few hints to Orvie, and the boy took off.

"She's steadier than the Bellanca, but not so responsive," he said, when he had circled and landed again.

"Naturally," was the reply. "A passenger-cabin plane isn't made for aerobatics. Of course, you can loop the loop with her or do anything else you like, but I don't advise you to. What we've been after is to eliminate air-sickness, for the sake of passengers. Get her into bumpy weather, and you'll be surprised. She won't bump; at least, to be honest, we declare that she bumps less than most. Want to take her up again?"

"I'd like to, if you don't mind?"

"Not a bit. Ask anything you've a mind to. By the way, you know 'Wasps', I suppose?"

"I've got both an engine mechanic's and an airplane mechanic's license," said the boy. "And I'm taking an engineering course, now."

"Then you haven't anything to ask!"

"Oh yes, I have, a lot!" And Orvie proved it with a series of searching questions, which he followed up by a day in the factory. When, two days later, he was ready to take the Amphibian off — the name *Pipestone* had been duly painted on her — he felt thoroughly at home with the craft.

"Are you going to run her over to Toronto?" he was asked.

"No," answered Orvie. "That would look like trying to show off. The news from down south is getting worse. I'm going there to see what I can do."

Ten minutes later, the big Sikorsky Amphibian was in the air and roaring over the country, with Cleveland as the first stop. Orvie dropped for a moment into the office of Porrit, the hunter who had been at Noocumpook Lake the first season.

"Going down to the floods to see what you can do to help, Orvie?" said Porrit, when he heard the news. "That's the stuff! Here!"

He opened a left-hand drawer and pulled out a check-book.

"Five thousand will help out to buy supplies and provisions for the homeless," he said. "I was going to send it to the Red Cross, but I'd just as soon it went through you. If you want more, wire me."

The boy flushed with pleasure.

"I'll — I'll make you a strict accounting, Mr. Porrit," he said.

"Good! It never does any harm to be business-like," said the broker. "I know lots of big men in business who would give more to charity if they knew exactly how the money was spent. That's what I like about air work. There's no roundabout to it; it's 'Johnny-on-the-spot' all the time. Why don't you go and see Merrill, too?"

"No," said the boy definitely. "It would look as if I were begging. I hadn't any idea of that when I dropped in this morning. I just came to say 'Howdy'."

"I know. Well, good luck to you, Orvie. Stop at the cashier's as you go out and cash that check; it'll save you a trip to the bank."

The boy left with his head in air. A magnificent machine, all his own, and five thousand dollars in his pocket to spend on relief work! What a chance!

Once in the air again, Orvie began to consider what he had better do. He would have liked to accomplish all the work on his own, but judgment told him that, if every one did that, there would be no organization and a good deal of overlap.

He dropped to the ground at St. Louis, though

with a certain amount of fear, for the ground was soggy and the Sikorsky had her pontoons but a very little distance above the ground. He came down with S-turns to have as short a run as possible, and though, once, after touching ground, she tipped a little, bringing one of the wings perilously near to the soil, so beautifully balanced was the plane that intrinsic stability was almost instantaneous and she landed without damage.

The boy was welcomed by the pilots there, some of whom were but a year or two older than himself, and the *Pipestone* was the centre of much interest, for many of the flyers had never seen a Sikorsky except at the Aeronautical Show. He gave a "joy-ride" to eight of them, enormously proud of his plane, as was only natural.

"Look here, Son," said "Buck" Diggers, "if you don't mind, I'll give you a tip about this flood stuff. Run down to Vicksburg. The Red Cross has got a headquarters there and I'll give you a letter to the local Director. Tell him that you're down on your own, but that you're ready to work under his orders. That'll put you in right, from the start, and if you do happen to get into a smash-up when you're flying for the Red Cross, they'll foot the damage bills. What's more, you'll have access to all the latest information,

and to the flood maps kept up to date by constant telegraph and telephone messages."

"But won't they set me to running supplies and that sort of thing?" queried the boy, who wanted excitement.

"Not likely. You see that Sikorsky of yours is a passenger plane, and nothing else. There won't be many of them on the river. Smaller planes can hop around and shoot supplies. Tell the Red Cross Director that you're after personal rescues. But, Son, do you suppose you can land on a rushing river?"

"They told me at the works that I could bring her down on fairly rough water."

The experienced pilot looked doubtful.

"Don't try it to start with," he said. "When I was there in 1927 the current was running at 20 miles an hour and better, and even the best of seaplanes isn't a motor-boat. Keep to still water, if you can. I'll show you what I mean.

"I remember," he went on, "that flood year, when I was flying just west of Lamont, while passing near a small shack, I noticed a hole close to the chimney and apparently something protruding. A head and shoulders appeared. The water was above the eaves. A negro of about thirty-five, and stout, scrambled out and frantically waved his arms, motioning us to

come down. The tragedy began to strike home very forcibly. In a small two-seater plane it was impossible to do anything for him. The current must have been running twenty-five miles an hour. A landing would have meant, in all likelihood, a loss of the plane, though it was a Vought and a pretty sturdy article. We circled around, and I waved my arm as a promise that we would tell of his plight. But I couldn't help feeling a bit mean as we flew away, though there was nothing to be done. In a case like that, though, if I'd had your *Pipestone* I'd have had a shot at it."

"That's exactly where I thought this would come in," ejaculated Orvie.

"It'll take handling," said "Buck" dubiously, "but, after all, a life is worth any risk. But that wasn't the only case, by a long shot. Why, only a few miles from where I'd seen the chap break a hole in the roof, I passed another house where there were a man and his wife waving a sheet. The current was running slower, there, and with a bigger plane we could easily have got them. The likelihood of getting to them by boat was remote, at least for a long time. I reported to headquarters, at once, and I believe a Coast Guard unit got to them — at least I hope so."

"But there was a heavy loss of life, wasn't there?"

"Very heavy," said the old pilot, gravely. "This flood isn't going to be anything like so bad — at least we hope so. You take my tip, Son, and work with the Red Cross. You'll meet other pilots, there, and they'll help you out a lot."

It was a good long flight to Vicksburg, and when Orvie got there he saw a number of seaplanes and landplanes, Army and Navy fliers. They clustered about him when the *Pipestone* taxied to a mooring.

"Lordy!" said one of the old Navy pilots. "Some new flying rule? The bigger the plane, the smaller the pilot?"

Orvie felt a little chafed, but he kept his good humor.

"Does a chap have to be over seven feet high to get to be an admiral?" he queried.

The pilot slapped him on the back.

"That's the way to talk, Bud. But you've got a whale of a ship. Who are you flying for?"

"Myself," said the boy. "It's my own plane."

They chaffed him unmercifully about it, and wanted to know where he kept his millions, but the chaffing was all good-humored. The fact that he did not mention anything about the way he had got the plane told in his favor, for the name *Pipestone*

had given one of the men the clue, and the story spread around.

The next morning he reported to the Red Cross Director.

"I know," came the prompt reply. "Buck Diggers wired me about you. As for work, you can hop off in an hour if you want action. See here. We're coöperating with the U. S. Army Third Mississippi District. An army observation plane has reported a break and spill-over of the Arkansas River between Swan Lake and Meto Bayou, about sixty miles air-line from Rosedale, on the Mississippi. It's not very thickly populated, but back of Langford and Reydel there are some scattered settlements. You may find something to do, there. It'll be fairly still water. Don't risk coming down either on the Arkansas or the Mississippi, Lee, it's dangerous, and in the main course of the stream, motor launches are the thing. Good luck — and remember, don't be foolhardy. Take your time and don't take any risks."

"Well," said Dawson, one of the Navy men, when he came out, "what's the orders?"

"I'm to go to Meto Bayou on the Arkansas and see what I can find. There's a 'spill' up that way."

"So much the better. It'll reduce the head of water. Look here, do you want me to go with you?

The Commander will give me leave. I know the country. My plane's being overhauled and won't be ready till to-morrow."

"I wish you would. Take the controls, if you like."

"No. It's your 'bus."

But the Navy flier looked pleased at the offer.

The *Pipestone* took off without a hitch and roared up the swollen river. In a little under two hours' flying his friend tapped him on the shoulder and said earnestly:

"Bear off to the right a bit!"

Orvie turned slowly and circled, flying low. Down and down they came, while Dawson scanned the waters closely.

"Looks like some one up a tree, there!" he remarked.

"Where?" Then, a moment later. "So there is!"

"Good chance for your first rescue, Son. There's hardly any current, here. Let's try for him."

The boy circled, brought the *Pipestone* into the wind and dropped gently to the water, taxiing up gently.

"Can you swim?" shouted the Navy pilot as they approached.

"I sho' can, Boss!"

"Come along, then!"

In a couple of minutes the negro had clambered aboard.

"You-all must ha' heard my prayin'," he said. "I jest have got to thank you-all. Lordy, it's like a house!" he ejaculated, as he looked around the spacious cabin.

"You know the country around, I suppose?"

"I was bo'n here, Boss."

"Any one else likely to be cut off by the water?"

" 'Mos' everybody!"

"Who? Think!"

The negro scratched his head.

"Napoleon Lamourou an' his wimmenfolk is likely cotched," he said. "Their place is right on a bayou bank."

"Which way?"

"That way, Boss. 'Bout five miles."

"We'll look for them. Give her the gun, Lee."

And the *Pipestone* rushed through the shallow water and rose easily.

"Lordy me! Is I flyin'?"

"Looks like it. What's your name? 'Conk'? All right. Now, where's that house you speak of?"

"Two hours 'way, Boss. Five miles."

"That's three minutes in the air, not two hours. Look down."

"Makes my head go roun'. That's the place! But the house is sho' gone!"

They circled a moment.

"Thar she is!" cried the negro. "Floatin'!"

But Orvie had already seen the floating shack and wondered if any one could still be there.

"Nap's mother's bedridden," declared their passenger. "She couldn't ha' got away."

"Big woman?" queried the lieutenant.

"No, Boss. All skin an' bone."

"Drop and taxi up," said Dawson to Orvie. "You, Conk, you'll get out on the wing barefoot, and carry her in."

"Me, Boss? Out there?"

"When we're on the water."

"Oh, sho'!"

But there was no need. As the *Pipestone* dropped and slid up to the house, the window opened.

"Nap!" called the negro. "Here's a real 'Fly Down, Sweet Chariot'. Come aboard!"

"Can't leave the wimmenfolk. An' Chloe's broke her arm."

Dawson's authoritative voice broke in.

"Get out there, Conk. Barefoot, mind! You, Nap, how many of you in the house?"

"Three, suh. Me, an' my old mammy, an' Chloe."

"Smash out that window, frame and all. That's the idea. See that there isn't any broken glass at the edges. Got a rope?"

"Ya'as, suh."

"Take a half-turn round that strut. Tie it to something in the house. I'll go out on the other wing, to balance. Conk, be ready to take the woman. Bring her out, Nap."

"Ya'as, suh."

He disappeared and returned a moment later with a very old woman, whom he placed in Conk's arms. It was a little difficult getting to the cabin, but the men managed it.

"Now, come out on this other wing with me, Conk. Can you carry your wife, Nap?"

"She can walk, suh, tho' she fainted once with pain."

"Bring her or carry her. We'll have her in the hospital in no time."

"Ya'as, suh."

It was a difficult trip for the half-fainting woman, but she tottered along the wing in safety and was placed in one of the cabin chairs.

"Take off, Lee!"

The rope was cut, the Amphibian turned off a trifle, splashed ahead through the water, rose and winged

her way back to Vicksburg. They got there just after dinner, having made 400 miles and rescued four people, one injured and another bedridden.

This day was a fair sample of many days to follow, though, afterwards, the boy flew alone. Thanks to the constant information brought by the Red Cross, few of his days were without a definite assignment, though once or twice he was free to prospect on his own account.

One group of thirty persons, marooned on the top of an Indian Mound and who could not be reached by boat, since the levee lay between them and the river, he brought back to Rosedale in four trips. They were already out of provisions, and one of them was in need of surgical attendance.

It meant a good deal of flying, for the Third Mississippi District, alone, contains 20,000 square miles, including 250 miles of the Mississippi and several thousand miles along the Arkansas, Sunflower, Yazoo, Red, Black, and Ouachita Rivers, as well as the Le Boeuf Basin. Orvie averaged four hours in the air, every day, the rest of his time being spent in overhaul. Within two weeks the worst of the danger was over.

Proud of his record, and still prouder of the fact that his plane had cost him only a couple of hundred

dollars for minor repairs, he got his log-book countersigned by the Director of the Red Cross and also by the U. S. Army District Engineer, and set back across country to St. Louis and Cleveland.

There he rendered his accounts to Porrit, being instructed to turn over the remaining money to the Red Cross, and started off next day for Toronto, to express his thanks, personally, to the President and Directors of the Lumber Corporation who had made possible this work with the *Pipestone*.

He spent the next week flying the officers of the corporation and their families, and secured two orders for the company which had manufactured his plane. His commission on the orders gave him a handsome sum in pocket. Then he flew to Washington, to show his log-book to the Department of Commerce officials, whose kindness in waiving the age exemption had made the flood rescue work possible, and back to his home in triumph.

He completed his victories by persuading his mother to take a fly in the handsomely appointed Sikorsky, and brought her to the ground, after the first flight, thoroughly converted.

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COMMANDER BYRD IN PLANE *JOSEPHINE FORD.*

Courtesy of Aero Digest.

THE *JOSEPHINE FORD* AND THE *NORGE.*
The first aircraft to fly over the North Pole.

CHAPTER XII

THE AIR MAIL

"It's all right to talk about the way that 'Europe is ahead of the U. S. in aviation'," said one of Orvie's fellow-students in the engineering course, "but the trouble of it is that it isn't true! If the European countries dropped their subsidies, there wouldn't be more'n three air lines running in Europe to-day. All short ones, too."

"Are you sure of that?" queried Orvie.

His classmate snorted.

"Sure of it? Of course I am. Who was the first to fly? — America! Who first flew round the world? — America! Who first flew from London to Paris, and to Germany? — America! Who first flew across the Pacific? — America! Who holds the record for endurance flights? — America! Who holds the record for altitude? — America! Who has the longest regular air-mail service in the world? — America! I wouldn't rub it in, of course, if I were talking in London or Paris, but it riles me up, sometimes, to hear

our chaps saying that Europe has got something on us, just because their passenger service is better developed than ours. I'm an old Air-Mail man, and I know!"

"The Air Mail is sure getting a grip on the country," admitted Orvie.

"Is it! You may not know it, but there are 14,037 miles of air-mail routes in operation (Official figures, Sept. 1, 1928) or there were last summer, when I got leave, to come here. And there are more now. And the Pan-American Airways will add a couple of thousand more. Put it moderate — there are fifteen thousand miles of air-mail route under our Post-Office Department alone. It'd take half a dozen European countries, put together, to tot up to that! Why, there's just one contracting firm, alone, the Boeing people, who've got 1918 miles of route all to themselves, just a little jump from Chicago to 'Frisco.

"I can fly better than I can talk, but when I get hold of a pilot who can talk as well as he can fly, why, I'm ready to listen. I heard Blaine Stubblefield tell of a flight like that, and it was good hearing. That's a U. S. Air-Mail line story.* Here, I'll get it for you. This is the way he puts it:

* This account deserves a place in air literature. It appeared in "U. S. Air Services" and has the real tang of the air in it. F. R-W.

" 'The distinction of printers' ink is claimed for this essay,' says he, 'on the ground that nothing is said in it about The Perils of the Night Air Mail, Hooded Knights of the Aerial Void, Intrepid Birdmen, or Winging Their Way.' "

Orvie laughed aloud.

" 'Hooded Knights of the Aerial Void' is a bird of a phrase!" said he.

"Isn't it? But, honest, I've seen titles just as wild! But Stubblefield — I don't know if that's his right name — just blazes ahead:

" 'Every one said that Oakland Airport was a good one — one of the best in the country. Lindbergh came along and said the same. We therefore offer no description, but climb into a Boeing mail plane with a camera and another passenger. Burr Winslow is behind the stick.

" 'We rise into the sunlight at 7 A.M. sharp, and turn into a tailwind toward Sacramento. The farmers in the valley, having come under the spell of radio announcers, have learned to stay in bed until daybreak and they now use the tune of our "Wasp" as an alarm clock.

" 'No gas is taken at Sacramento, because it is only 175 miles to Reno, the first division point. After a two-minute stop for mail, we crack throttle and are off again. A fifteen-minute search reveals a hole in the ceiling and we dive up through, as the lady pas-

senger said, into a blue sky. The Sierras stand up to the East like mountain islands in a frozen sea covered with snow. There is nothing quite so white as the top side of a cloud strata in the sun. It stretches away, a lonely world by itself.

" 'Seventy-five miles of this without a peep at the ground, and we are over Emigrant Pass in the Sierras, better known among pilots as "The Hump." There is where the gold crusaders of '49 saw the end of the trail to the land of gold. You cannot fly long enough to be on familiar terms with this mighty place. One sees it in a new mood each time, seemingly defiant of the men who ride easily over its canyons and bluffs, quite independent of its blusters and threats.

" 'Vaulting The Hump, one looks down into the mouth of Truckee Valley where it joins the desert country. In the midst of this brave spot, set in a mosaic of green in various shades of crops, is Reno. Last Chance in the jump-over for Sacramento in the days for gold! Breathing station for giant locomotives and scene of the fatal wreck where Casey Jones became an angel, Casey Jones, folk-lore hero of rail and throttle in its heyday. He died at Reno Hill, eight hours late with the Western Mail. But other men have come to beat his time over The Hump. Down from the summit we came, at half throttle, and rested on the old Government mail field, still only an hour and forty-five minutes from San Francisco.

" 'Again we headed out over the parched mountains and deserts, this time with Harry Huking. The

plane was just from the factory, all trimmed up and wearing a new "Hornet" on its nose. We got over to Elko and as there was an extra plane on the block, the pilot, Hugh Barker, suggested we go along together and get some pictures of the ship in the air. Hugh and Harry agreed to go straight through Secret Pass in the Ruby Mountains to get some wild scenery.

" 'One can take his choice of flying directly on the course over the pass, or going to the left around the end of the range. It is usually quicker to go round, because the distance to the Pass is too short to make altitude. We started with our nose high. The "Hornet" complained in pipe-organ bass, but pulled us up the steep slope.

" 'The Rubies are wild and rough as a saw. Secret Pass, 10,000 feet aloft, might have remained "secret" forever so far as most of us are concerned, if we had to struggle up it afoot. In these days of sporting-page athletes, folding beds, and canned heat, men with enough pedal ambition to crawl up there are few. But it's easy for the Air-Mail traveler. He simply sits there and looks carelessly at grandeur which only eagles and other high-ceiling fowl hitherto have been permitted to see. We hit some powerful drafts over the backbone of the range but our good engine blew them out of countenance, and we slid over into the Great Salt Desert — the largest aerodrome in the world, as worthless to commerce as the North Pole. Taken by and large, this place is somewhat disconcerting.

" 'What remains of this inland sea, which once covered the Great Basin country, we presently see to the fore and left — Great Salt Lake. Salt Lake City appears in the foreground of a rugged scene. The Wasatch Peaks, our first glimpse of the Rockies, rise abruptly behind the city, seeming to challenge farther Eastward progress of the mail. The dome of the Mormon Tabernacle catches the eye; then the pinnacles of the Temple, where Moroni stands, sounding his golden trumpet to the East.

" 'Salt Lake City, with five routes, ranks third among the Air-Mail depots of the country. Chicago is first, and Cleveland second. Six or seven hangars; busy mechanics; pilots taking a last pull at a cigarette; ships fading out to the East, North, South, and West; Allen, our next pilot, getting into his suit.

" ' "We can get through that all right," he says, in reply to some anxious glances at some stormy drapery hanging over the Wasatch. "There's a good ceiling in the canyon. We'll go as soon as the Western Air gets in."

" 'Presently a Douglas came over the hangars with the mail from Los Angeles. A thousand pounds of mail was stacked into the Boeing's pits, and we took off.' "

"A thousand pounds!" exclaimed Orvie.

"Well, the Air Mail carried over thirty million letters last year, at special rates, and it'll nearly double that next year. But let's get back to the trip.

" 'Heading for the Wasatch we seem doomed to certain disaster, but, as we approach this rugged range, a spacious canyon appears to let us through. The Rocky Mountains rise high on the right. They are entertaining a lusty blizzard, the edges of which hang down in our path.

" 'Flying through rain or sleet is rough business if one exposes any cuticle. He might as well submit his hands or face to be burnished by a sandblasting machine. One puts his head out of the window to see an approaching squall — only once! Precipitation seen from an airplane is always horizontal. So far as the observer is concerned, it will never fall to the ground at all, but will continue to the rear indefinitely.

" 'The Rockies are spread over a considerable area of this country, according to the map. One would think he would have to wear out the rudder dodging between rugged peaks. But, as a matter of fact, there is plenty of room between them and they are not nearly so rocky as the Kit Carson stories would have us to believe. For the most part, the course lies over ground on which we could sit down.

" 'We make a fast landing at Rock Spring, 6500 feet above sea level, take on fuel, and are off again. A couple of hundred miles farther East, over lonely plains where the coyote howls and the wind sports free, the prairie reminds us of our grandfathers, oxing along at three miles an hour and scanning the horizon for Indians out of control.

" 'We "top out" at Sherman Hill, 30 miles west of Cheyenne. Sherman Hill is the ceiling of the Transcontinental, being about 10,000 feet above sea-level. The Sherman Hill beacon — on one of the issues of the five cent air-mail stamps — is said to be on the highest location in the world. It is not the Continental Divide, though, which is not the collar-bone of a mighty range, but a broad expanse of rolling country, studded with numerous small lakes and ponds and some straggling range horses. It was a cruel disillusionment, for now I can never enjoy any more of the Great Divide stories.

" 'It's a long way from the Golden Gate to Cheyenne, and one is inclined, upon landing there, to check back over the brief hours of daylight since we left the Pacific Ocean to see if there isn't something wrong, somewhere.

" 'Reaching North Platte, we begin to feel that we are back East. Likewise, the aeronautical Marco Polo of the same day, arriving at the same point, doubtless inhaled a lung-full of sage-brush perfume and felt that he was getting out West. Passing on, an infinity of green fields and summer fallow below impresses the traveller with the real reason for the Congressman's frequent references to the American Farmer. It is necessary, however, to imagine all this, for darkness overtook the air mail just out of Cheyenne.

" ' "Aloft in the Dark" would be a sizeable subject for even the best of adventure-story mechanics. The

experience offers unlimited inspiration for the usual hooey about such things, but there must be very few writers who could capture the reality at hand with accuracy. It has been done by a few of them. The beacons revolve their long beams aslant the sky, flashing an instant in the cabin. The blinkers wink their friendly message that we are on the course.

" 'To one flying an airway at night, the world is only a chain of lights in a void of darkness — and the ship. The "Hornet" bellows his deep song, steady as a waterfall. The staunch Boeing structure assumes a new significance.

" 'At Omaha; it is midnight. Lights play on men transferring a truckload of mail to another ship. Slim Lewis, our pilot from Cheyenne, walks away, saying that he is going to bed. Slim is next to senior pilot in the Air-Mail service. If he had paid postage on himself for all the air-mail riding he's done, the bill would look like a war indemnity.

" 'Steve Kaufman has the next relay to Chicago.

" ' "We've got a tail wind," he says, glancing at the sock with a pleased eye. "Let's be going!"

" 'The BBT floods the field, and we're up again.

" 'Walt Whitman could have approached Chicago by air at dawn in good prose. He caught the spirit of ships and locomotives and cast it in iron letters. But Walt Whitman left us too soon. He should have come in, by air, on the Eastbound.

" 'Breakfast in a downtown hotel. Breakfast 22 hours ago in San Francisco. To men of carbonized

minds it is inconceivable. Only the new crop can comprehend it.' "

"And that," said Orvie's classmate, "is flying as seen by a flyer."

"It's red-hot stuff," agreed Orvie, "and no one's going to doubt that the Air Mail gets over. But how about passenger service?"

"Just the same thing! People don't mind travelling in a train by night, why should they in a plane?"

"Breakfast, lunch, dinner, and bed," retorted the boy. "Four good reasons. There's no restaurant car and Pullman on an airplane, not even on mine. And a man who's willing to spend a couple of thousand on travelling isn't hankering after a ham sandwich and some Thermos coffee, for his 'eats', and sleeping in a chair."

"Stop over for the night, then!"

"You don't gain anything on the train, if you do. The Limited goes on running all night. If there were a crackerjack hotel at every Airport, it might help. But at most of them you can't even get ham-and-eggs, much less a good meal. To do the thing right, from New York to 'Frisco would take three jumps, at best, long ones. And you'd have to stop over the night, say, at Chicago and Denver. You wouldn't beat the Limited by much. It's all right

to be optimistic, but I think some air-stuff writers are apt to do a little tall talking about putting the railroads out of business, and all that rot. To my way of thinking, the airplane will no more put the railroad out of business than the telegraph has put the postal service out of business. But there are cross-country hops where railroad construction is difficult and where air passenger lines will become part of the regular service. Take the Alleghanies. Traffic from Virginia into West Virginia isn't exactly what you would call speedy, and a plane can hop in an hour the mountains that it takes a train a whole day to climb. From North Carolina to Tennessee, too. But these are special cases."

"And what do you think of freight transport?" queried his classmate.

"A much more difficult problem," said Orvie. "I went into that very fully with the President of the Lumber Company who gave me the *Pipestone.* I couldn't advise him to go into it."

"Why not?"

"That's a long and complicated question. I'll go into it some evening, with you, if you're interested. I dug up all sorts of statistics which I can't remember now. But I'll give you one or two of the main difficulties.

"First of all, a fleet of aircraft represents capital, and unless every plane is working all the time, it means that capital is lying idle. To work every plane every day either means long hauls, or a lot of freight traffic over short hauls. Owing to the need for constant overhaul, to use a plane every day means a ground crew working over it every night, and night labor comes high. The paying load per unit of horse-power which an aircraft can carry is so much higher than the cost of transportation by road and rail that the difference in speed doesn't compensate. No big increase can be expected till charges are reduced, and charges can't be reduced until there's a big enough traffic to keep fleets of planes going and thus reduce overhead, for maintenance is an enormous item. Both rapid depreciation and obsolescence of airplanes add to cost. Commercial airplanes need commercial landing-fields, and ground rent is prohibitive. Then — "

" 'Sakes, Orvie, that's enough! To hear you talk, the airplane might just as well never have been invented."

"Nonsense! It doesn't do a problem any harm to state it, does it? We're only at the beginning of aviation, and, remember, Harry, that the Governments of all countries stand ready to subsidize air devel-

opment, while cities are spending millions on airports, night-lighting of airways, and such things."

"A big part of aircraft operation is subsidized, isn't it?" said his friend, reflectively.

"It has to be. Private capital couldn't begin to do all that has to be done."

"And every airplane and airship can be used in war, of course."

"That's one thing," agreed Orvie, "but I don't think that war preparation is the main idea of the U. S. Government. European countries think of national defence, first, of course, and I don't blame them for it. I won't name any names, but it's an open secret that four countries, at least, are just pining for a chance to get into another war.

"The U. S. has a different angle. We taught the world to fly, we've got the soundest Air-Mail system in the world, and, though geographic conditions make it natural for Europe to get more passengers on subsidized air-lines, we're likely to be the first to solve the problem of air freight. The United States Government has faith in the future of aviation, it's got the money to spend, and it knows that every dollar given to the aircraft industry is building for the future."

CHAPTER XIII

POLAR ICE

"I SHOULD like to be the first man to fly over the South Pole!"

Thus spoke a big-muscled Westerner to Orvie, as he sat in a hotel room at Washington, after the completion of all the tests necessary for his Transport Pilot's License.

"So should I, Mr. Gallohan," said the boy, looking at his visitor's card, and wondering what was coming.

"You've got the plane, and I've got the money;" the phrase burst out like a pistol-shot, "how about it?"

"You mean you want to finance an Antarctic Expedition?"

"That's the idea."

"And who is to command it, to lead it?"

"We two. You and I."

Orvie leaned back and smiled. It did not seem possible that his visitor could be in earnest.

"If you have money to spend for scientific pur-

poses, Mr. Gallohan," he said, "especially if it's for work either at the North or the South Pole, I think I can tell you exactly what to do."

"And what's that?"

"Send the money to Commander Byrd or to Captain George H. Wilkins."

"But I want to go, myself!"

"Nothing to stop you. Finance an expedition, pick out a leader with long experience in the Arctic, see to it that every member of the expedition — except yourself — knows Polar sea and land ice, establish good bases this year and prepare to fly next year, and, if you're footing all the bills, the leader of the expedition will take you — if he thinks you can stand the trip."

"You won't take the *Pipestone* yourself? You've got cold feet?"

"Mr. Gallohan," said the boy seriously, "if you can afford to spend half a million dollars to finance a polar expedition, you can afford five dollars on books. Get Byrd's 'Skyward', Amundsen and Ellsworth's 'First Crossing of the Polar Sea' and Wilkins' 'Flying the Arctic'. Read of their years of painful experience, of their long training, of the appalling precision of preparatory detail which such work requires, and of their numerous failures before achieving a final vic-

tory, and you'll begin to understand what Polar work means. I haven't got cold feet, and I'd go on an expedition in a minute, but I'd figure on ten years' training under a competent leader before I'd even think of doing anything on my own."

The Western range-owner stared.

"Take Byrd," said the boy, warming up. "Why, back in the World War, he was the first to plan a trans-Atlantic flight, he established and directed the first seaplane station at Newfoundland, he was assigned to the big British airship to be flown to America and only escaped death in that disaster by missing the train which he was to take to the fatal trial test, he had the Navy back of him, he was associated with Donald B. MacMillan, an Arctic explorer, he had the help of Capt. Bartlett who went to the last lap but one of the North Pole with Peary, he spent a summer at North Greenland with the Eskimo, he got a thorough training of Polar conditions by flying over Ellesmere Island — one of the worst ice regions of the world — his plane sank at the edge of the ice fringe; another time the crew had to battle for hours with an iceberg, all hands nearly lost their lives over Grinnell Land, and four forced landings on ice which was perilous in the extreme were just a few of the troubles of his Greenland expedition of 1925. And that was only for a starter!

"Just for one thing, Mr. Gallohan, read how, at the very beginning of the polar flight, their plane, the *Josephine Ford,* had to be taken through moving ice on a raft. They had to change and make new skis for the plane. Fires had to be built on the ice to thaw the oil before it could be put in the engines. In the trial take-offs there were three upsets, and these three crashes would have been absolute disaster to any one not trained to the last notch in polar work.

"And for the last great flight, the risk of the take-off was tremendous. The runway in front of the skis was carefully iced, and the *Josephine Ford,* with her load of 10,000 pounds, had to lift or smash on the jagged ice at the end of the runway. But the big three-motor Fokker monoplane made it by a narrow margin, and the work of navigation began.

"Have you ever stopped to think, Mr. Gallohan, what navigation with special instruments must be over a sheer field of ice? Byrd froze his face and one hand in taking sights with the instruments from the trap-doors. Byrd is a very highly trained navigator, who has made air navigation his hobby for several years — and that was a large cause of his success.

"And you think, sir, that one can just hop in a plane and fly off like that!

"Just read the details of Byrd's navigating! He

passed near where Nansen had struggled so heroically over weary mile after weary mile, he crossed Peary's oft-travelled trail before the last splendid victory came to the greatest of all Polar discoverers, and then — came a leak in the oil tank.

"But at three minutes past nine in the morning, May 9, 1926, Byrd reached the Pole. Sights and calculations followed with absolute accuracy and trained speed. Why, just the mathematics alone would be beyond most college professors! Then, to make sure that the Pole had actually been reached, Byrd went on and made a second and larger circle round the Pole. But navigation up there was a puzzling problem. That never occurred to you, did it?

" 'Time and direction became topsy-turvy at the Pole', Byrd wrote. 'When crossing it on the same straight line we were going north one instant and south the next. No matter how the wind strikes you at the North Pole it must be travelling north, and however you turn your head you must be looking south. Our job was to get back to the small island of Spitzbergen which lay south of us — and south was all round!

" 'Were we exactly where we thought we were? If not — and we could not be absolutely certain after that circling — we would miss Spitzbergen. And

even if we were on a straight course, would that engine stop? It seemed certain that it would.

" 'As we flew there at the top of the world, we saluted the gallant, indomitable spirit of Peary and verified his report in every detail.

" 'Below us was a great eternally frozen, snow-covered ocean, broken into ice fields or cakes of various shapes and sizes, the boundaries of which were the ridges formed by the great pressure of one cake upon the other. This showed a constant ice movement and indicated the non-proximity of land. Here and there, there was a separation, leaving a water-lead which had been recently frozen over and showing green and greenish-blue against the white snow.'

"A quarter of an hour later, the *Josephine Ford* set back for Spitzbergen. The elements were favorable. And to Byrd's great astonishment, the engine went on running. And — what is to me the most amazing marvel of all, Mr. Gallohan — Byrd had managed to navigate with such unerring accuracy that he made an absolutely straight line for the point that he had left, and came flying at good altitude and high speed for King's Bay. He had attained in a flight of fifteen hours and thirty minutes what Peary achieved, seventeen years before, after weary months of travel and nearly twenty years of effort. So much for Arctic navigation, sir. And you think I'd be fool

enough to suppose that I could do a feat like that!"

"I didn't know it was such a job," said the Westerner, a little more humbly.

"Amundsen, Ellsworth, Riiser-Larsen, and Nobile, the builder of the airship, *Norge,* were all at King's Bay when Byrd set out and came back. It was the very next day that the *Norge* started out on her flight, also to cross the North Pole and to be the first aircraft to fly across the Polar Sea from Asia to America. But if you want to realize what that meant, Mr. Gallohan, read of the preparations for that voyage. The credit lies almost entirely with Amundsen and Riis-Larsen. Nobile's actual handling of the craft left nothing to be desired. And they, too, had been vanquished at 87°43′, the year before.

"But, this time, the *Norge* was leaving nothing to chance, or more accurately, every preparation that Roald Amundsen's long Arctic experience could suggest had been taken. If the *Josephine Ford* had had the benefit of the counsel of Capt. Bartlett, the right-hand man of Peary, discoverer of the North Pole, the *Norge* was under Roald Amundsen, discoverer of the South Pole. That doesn't look much like haphazard leadership, does it, sir?

"The *Norge* took the air from King's Bay just before ten o'clock on the morning of May 10, 1926, just

a few hours after Byrd returned. Indeed, Byrd did a very sportsmanlike thing. Although worn out from the Polar trip, he took up the big three-motor Fokker and circled around the airship to bid her '*bon voyage*'.

"An airship is not as speedy as an aeroplane. When the *Norge* had been in the air ten hours, fog came. Two hours later the fog became dense, but fortunately, shortly before reaching the Pole, it cleared. At 1.15 A.M. of the 12th, Riis-Larsen went down on his knees and measured steadily through one of the port-holes from which the coverings had been removed. When the reflection of the sun and the bubble for the artificial horizon lay side by side, sharply touched by the marking threads, Riis-Larsen announced 'Now we are there'! It was 1.25 A.M. Beneath them lay the polar basin, bathed in sunshine. Speed was slackened and the *Norge* went down to 600 feet altitude.

"Out flew the Norwegian flag. It was on a cross-bar fastened to a long aluminum staff exactly like a standard. It landed correctly, fixed itself in the ice and the light breeze fluttered the Norwegian colors. Amundsen turned round and grasped Wisting's hand. No word was uttered. It was unnecessary, for these two men's hands planted the Norwegian flag at the

South Pole on the 14th of December, 1911. No other men have even been at both Poles.

"Then the Stars and Stripes flew out. It was with an extraordinary, an indescribable feeling, that Ellsworth undertook the task. When again will a man plant the flag of his country at the Pole on his own birthday? Lastly, Nobile threw down the Italian flag. Thus all three flags stand a few yards apart as near the Geographical North Pole as any human beings can determine with instruments.

"But the purpose of the voyage of the *Norge* was not only to reach the Pole. The main intention was to fly from continent to continent across the Polar Sea. With very little drift, the airship continued over broken-up ice with not a particle of open water to be seen, and at 8.30 A.M. met thick fog which lasted all day. Occasional breaks in the fog always showed sea ice below. At 6.45 A.M. on the 13th, the *Norge* sighted land. It was a great moment. The flight had been accomplished and the goal reached. The *Norge* reached the coast of Alaska, some miles west of Point Barrow. Over the Bering Straits the *Norge* was tossed and buffeted about and at last took land near Teller. The flight from continent to continent was achieved."

"But didn't Nobile go up to the Pole again, re-

cently?" queried Gallohan. "Seems to me I heard something about it."

"There's no need to talk about that disastrous and fatal-ending trip," said Orvie, shortly. "To my way of thinking, it will be remembered in the history of aviation only as having been the cause of the heroic but useless deaths of Amundsen and Guilbault, who volunteered on an airplane rescue. Amundsen found his grave in the Polar Ice, but he has both the North Pole and the South Pole for the world's eternal memory.

"But whatever may be said about that airship attempt, the pluck of another American air-explorer, Capt. George H. Wilkins, is beyond all praise! It was Roald Amundsen, himself, who spoke of Captain Wilkins' flight in the Arctic as 'the most splendid achievement in flying that has yet been done.' "

"I haven't heard much about it," said the Westerner.

"No," Orvie agreed, "for some reason or other it never caught publicity the way that flights to the Pole have done. But Wilkins had far more Arctic flying, encountered more difficulty, and fought out harder conditions than any of the airmen before him. In his own words: 'We begged for money, bought machines, flew them and smashed them, rebuilt them

and smashed ourselves. But we have done the work in the Arctic that we meant to do'.

"Just take a look at Wilkins' adventures — all with the aid of men thoroughly competent and experienced — and I think you'll feel a little differently, Mr. Gallohan, about the magnificent courage and skill that Arctic work requires. Right at the start of the first trip, Hutchinson, a newspaper correspondent, who had volunteered to turn the propellers over, slipped under them and was killed. That was before the *Detroiter* had even taken the air.

"A week later, the runway having been prepared, Wilkins decided to test out their single-motored plane, the *Alaskan*. Both were Fokkers, the single-engined plane having a Liberty engine, the tri-motor plane being equipped with 'Whirlwinds.' The *Alaskan* took off, with Eielson, a splendid pilot, at the control. All went well, but just before landing, the plane stalled and, when she levelled and the pilot opened the throttle to regain speed, the engine did not pick up; so she crashed. It was only the fact that the snow was soft that prevented the death of both men.

"Three days later Wilkins went up with the *Detroiter*. She also handled well, although the pilot was not used to her, but, as though a veritable demon

were there to suggest error, Lanphier, the pilot, made the same mistake as Eielson, stalled and crashed. It was a wreck, and weeks would be necessary to repair it.

"They set to work to repair the machines, though weather conditions became bad for flying. After three weeks the *Alaskan* was ready again. They started again on March 31, 1926, with Eielson at the controls. Though not as good as before, the single-engined Fokker climbed well, but the fliers soon found themselves in a dim grey mist which hid everything, though the sun's rays pierced through it feebly.

"After flying well out on the Arctic Sea pack-ice they chogged back, and, trying to find Point Barrow village, dropped from 4000 feet to 2000 feet. There was a howling blizzard on land! They climbed again to 4000 feet, lost, absolutely lost. Figuring and dead reckoning were their only hope. The strain on their nerves was such that the men saw Eskimo villages everywhere! The Aperiodic compass saved them. They struck a faint line which Wilkins recognized — or thought he did — as part of the Arctic shore; more by that sure sense of direction which is the explorer's particular gift than anything else, they came to Barrow, only to be forced

to try for the first time the hazardous experiment of landing on snow with ordinary wheel landing gear. Eielson managed it perfectly. To make a long story short, five days later they flew to Circle City, landed there safely, and, next day, flew back to Fairbanks, having carried out on their vamped-up machine the longest non-stop flight made in the Arctic."

"I like that," said Gallohan. "It takes grit to start out after two failures on a self-repaired machine!"

"But their hope was in the *Detroiter*", Orvie went on. "To get plenty of gasoline to Point Barrow the *Alaskan* had to do the work, and, the very next day, they took her over the Endicott Mountains with a load of gas. But, climbing into the machine, as she started, Wilkins' mitten got caught in the wheel and his wrist snapped. On the way back the wind drifted them out of their course, they could not find their way, and, once again, Wilkins' profound study of the whole country enabled him to give directions homewards. They reached Fairbanks with less than a gallon of gas in the tanks. A near thing, Mr. Gallohan!

"Just the same, despite his broken wrist, Wilkins and Eielson set off next day, crowding the *Alaskan* with an overload. She wouldn't rise over the mountains. There was no going back. Eielson drove the

plane towards a narrow pass — no one knew about it and it wasn't marked on any map. Fog filled the valleys, and high clouds covered the range.

" 'There was no hope of passing over the clouds with our heavily loaded machine,' wrote Wilkins, 'and to find a safe air-way between the mountain peaks was not simple. . . . There were many cases of gasoline on the floor, and to give the machine every advantage for climbing, I placed all these cases up near the pilot's cockpit. As I was doing this, we came to a very bumpy area, the plane was tossed and turned so that I lost my balance and fell against the cabin wall, again fracturing my arm which had just begun to grow together.

" 'Just then I noticed, on the left side of us, a sharp mountain peak. It seemed as if we must smash into it. I hurriedly motioned to Eielson to keep to the right, but he indicated that there was a peak on his side also. There was not time to turn. The only thing we could do was to risk passing between those walls of rock.

" 'Even if we had sufficient height it would have taken a cool-nerved pilot to fly the machine through that narrow gateway. Eielson kept steadily on. Climbing the machine as much as possible, we passed through the gap with only a foot or so to spare between the wings of the machine and the walls of rock. As we went through this gap, I looked down and saw that the wheels were spinning. The wheels

had dragged through the snow ridge as we squeezed between those peaks.' "

"Great Rattlers!" ejaculated Gallohan. "That was a hair-raiser!"

"The next thing was that, just before starting back, an Eskimo who had been set to heat the engine put too much seal blubber in the stove and set fire to their plane."

"Tough luck!"

"It didn't seem much damaged, but it was enough. On their way back they were caught in a queer cloud formation with pillar-like blasts which tossed the machine 'like a sheet of paper in a windstorm'. Useless to go on. Only by clever flying did they manage to get back again to Point Barrow.

"But the Eskimo's seal blubber fire had done its work. Starting off again, next day, the propeller began to come to pieces. Wilkins sent a wireless to Lanphier, at Fairbanks, bidding him hurry the *Detroiter*. Lanphier wired that he had tested the machine and that she wouldn't run. Mad as a hatter, Wilkins fixed up the disintegrating propeller of the *Alaskan* with brass wire, and flew it to Fairbanks, anyhow."

"Great stuff!" Gallohan was getting excited, now.

"Then he started to tinker up the *Detroiter*. She wouldn't go. The propeller was all out of balance, and the engine raced like a mad thing.

"A new propeller had come for the *Alaskan*. They stuck it on, but for some reason or other it gave no power and the machine refused to budge. Back they put the propeller which the Eskimo had spoiled and Wilkins had tinkered up.

"Off again with the *Alaskan*. A wild taxi, and, just as she was about to rise, a bump and a crash. The right wing had given way. As the machine crashed, the loose cases of gasoline fell on Wilkins as he was hurled into the snow and the gas from the machine poured on the hot exhaust pipe and all over Wilkins himself. A spark meant explosion and instant death. They dragged him away, dug out Eielson — neither injured — and found the *Alaskan* wrecked beyond repair.

"Spring and continuous fog were coming. But Wilkins was hard-set and he took the *Detroiter* up — it was extraordinary how the men got her to go — and though she ploughed through fog all the way, and nose-dived once to win ten feet of the tundra, she reached Point Barrow in safety. And, while waiting there for a single clear day, they saw a dark object in the skies. It was the *Norge* crossing from

continent to continent over the Polar Sea! But the fogs had come. The season was at an end. If not a complete failure, the expedition was very near to it.

"It would be a long story, Mr. Gallohan, to tell of all Capt. Wilkins' trouble to get funds for another try. But he managed it. I'll jump to the next effort, this time in a Stinson biplane. Just a mere description of the scientific equipment of that plane, Mr. Gallohan, would make you open your eyes!

"They left Point Barrow with a ground temperature of 42 degrees below zero. Four hours out, the engine began to sputter; half an hour later, she missed badly. It meant landing on the ice in the dark. Eielson brought her down and hurried to examine the engine while Wilkins took sea soundings and secured valuable scientific data.

"It took them two hours fiddling with the engine — at 30 below, here — before she picked up again. Off into the air once more! Ten minutes later — engine trouble; nothing but Wilkins' long experience of Arctic travel afoot enabled them to find a landing place. They labored at fixing the engine, Eielson with four of his finger-tips solidly frozen. Later, a finger had to be amputated. It's no fun to be a mechanic on the Polar ice!

"Up again, with the engine running again, and

then thick fog. After fourteen hours out, the *Stinson No.* 1 was above one of the most dangerous districts of Arctic ice. Visibility, nil. Wilkins says himself:

"'At 9:02 the engine cut out suddenly, as if the switch had been snapped. No splutter or gasp because of a starved carburetor, but sudden silence. We could feel the sag of the falling plane. Near the ground the air was bumpy. The plane swerved and pitched, but Eielson — still calm and cool — corrected with controls each unsteady move. As we came within a few hundred feet we could see ice ridges. In a moment we were in a snowdrift. The left wing and the skis struck simultaneously. We bounced and alighted as smoothly as on the best prepared landing-field. . . The fabric of the lower wing was torn. The machine still rested on the skis, but they had turned on their sides, the stanchions twisted and broken. A wireless message was sent — and the two exhausted men slept.'"

"What then? Where were they?" cried Gallohan.

Orvie stopped and looked at him.

"Fifteen days," he said, "fifteen long weary days they struggled through snow, ice, and water, walking and dragging improvised sleds. The story is too long to tell. But it's an heroic thing to read! I'm telling you of flying, only.

"Did Wilkins give up then? Not a bit. He took the other biplane up, but the engine just went to pieces almost immediately. An Eskimo was sent for repairs, and the plucky explorer managed to fly the plane back to Fairbanks. There was trouble with the new pilot, for Eielson could not act. The other plane could not be made to work well. A second season came to its end as the fogs began.

"The third year! This time Wilkins took a Lockhead-Vega with a 'Whirlwind' engine, a plane to which — as he confessed himself — he had lost his heart. She flew the Arctic country from Fairbanks to Barrow as easily as around a landing-field in the southern States. But there was a long wait at Barrow, and two false take-offs nearly brought ruin. The final take-off — after weeks of preparing a runway — was a perfect one, and the Lockhead-Vega purred above the ice in unbroken smoothness. To Wilkins, a man who knows Arctic ice in all its details, the country below was an open book.

"Hour after hour passed, Eielson at the controls, Wilkins navigating and making unceasing observations. Close examination was made for land, but no land was seen. Thirteen hours in the air, and they found themselves between two storms between Grant Land and Greenland, a dangerous district. There

was a tolerable ice-landing in sight. Should they go down, or go on? Eielson was willing to go on. They went on.

"The two storms seemed to meet in front of them. Eielson climbed the machine to 8000 feet, but the clouds were still high above them. Flying at an altitude meant loss of fuel. They nosed down and commenced weaving in and out of the cloud masses. Gas was getting low. The engine had functioned perfectly, but it had been a hard driving trip.

"A sight of land, and then the storm took them and flung the plane about savagely. Needle-point peaks appeared, but Eielson handled the plane superbly, though every minute seemed the last. They circled around a small mountainous island and, at last, saw a white patch which suggested a landing-place. The blizzard raged savagely. As they came down, everything was lost to sight in snow. Eielson brought her down on an even keel, absolutely undamaged, and in as perfect condition as when she left. A taxi of thirty yards into a loose snowdrift, and everything was safe. It takes a real pilot to do that!"

"And where were they? On land or sea?"

"They didn't know. But if Wilkins' calculations were exact, they must have been on the west coast of Spitzbergen, perhaps not more than a hundred miles

from King's Bay. There were twenty gallons of gas left. Even so, the great feat had been accomplished. An airplane had flown across the Polar Sea.

"They were on Dead Man's Island. Five days they had to stay there. At last the weather permitted them to start, but, to break free, Wilkins had to push on the tail. Twice he tried to climb in as the machine rose, twice he was thrown off and the plane rose without him. Twice Eielson had to land again. The third time, as he rose, Wilkins got his fingers on the rim of the cockpit and tumbled in, safe but covered with bruises. Ten minutes later the radio towers of Green Harbor came into view. They landed safely at their foot. After three years of savage trial — victory! Two men, alone, had covered 2200 miles of Arctic snow and ice, 1300 miles of which had never before been seen by man.

"And now, Mr. Gallohan," said Orvie, "do you still think that it's because of 'cold feet' that I said I couldn't take you on a Polar expedition?"

The Westerner rose and held out his hand.

"It just goes to show," he said, "how many different kinds of a fool a man can be when he begins to talk of something he knows nothing about. But I can take my medicine! I'll tell you what I'll do —

I'll send a check to Wilkins and to Byrd for their next expeditions."

"And," added Orvie, "to Norway for the Amundsen Fund."

"I'll do it, and I'll do it to-day," said Gallohan, "and if ever you do go on an Arctic trip, boy, remember that your personal equipment and anything that you may need comes from me!"

CHAPTER XIV

PAN-AMERICA

"Switch off?"

"Switch off!" replied Orvie.

"Gas on?" queried the ground mechanic.

"Gas on!"

The mechanic swung the propeller sharply through three or four turns to suck gas into the cylinders, placed the blade at an angle marked to show when one piston was in firing position, shouted, — "All clear?" and stepped back.

"All clear!"

Orvie snapped on the switch.

The engine coughed and broke into a steady purr; a moment later, the *Pipestone* ran across the New Orleans landing-field and rose swiftly and smoothly in the air. Major Lee was in the observer's seat.

This was to be the determining flight of the boy's abilities. Some months had passed since Gallohan's offer to finance an Arctic expedition, and Orvie had spent this time partly in flying guests to the hotels

on the Thousand Islands, and partly in a close study of air navigation, or "aviation."

In this he had found an enthusiast in his father. Major Lee, though an ace in flying, had done little long-distance work, and, having received his training in war-times — when short flights, only, were needed, — he had done but little navigation. With his characteristic interest in any new thing, however, he had thrown himself into navigational study, and Orvie — in spite of class instruction — found that his father learned even more quickly than he did.

Orvie had gone into the matter very thoroughly, and had several kinds of compasses on board, the parallel grid or P.2, an aperiodic compass for use with a radiognometer, and an Earth Inductor compass, such as was used by Lindbergh and Chamberlin. He had learned to use the R.A.E. artificial horizon or bubble sextant, and, of course, he had become fairly expert in the reception of direction-finding radio. A new model of drift meter, to indicate the angle at which the plane is being driven from her course by side-winds, had been tested out and proved most effective.

Of course, the usual instruments were quite familiar to him: the altimeter, a form of aneroid barometer to show altitude in hundreds and thousands of

feet; an air-speed indicator, essential to determine the most economical cruising speed; the inclinometer, very useful to show whether or not the craft is on an even keel, a matter by no means easy to determine in a fog; the gyroscopic turn indicator which acts as a sensitive correction to the compass; the rate-of-climb indicator, which gives notice if a climb is so abrupt as to menace a stall, or a dive too severe for the margin of safety; the air-distance recorder or air-log, absolutely essential for dead reckoning; and the engine instruments, such as the tachometer to indicate the speed of the engine in revolutions per minute, and the pressure, gasoline-level, and fuel-flow gauges.

Map-reading — which is far more of an art than it seems — had been thoroughly drilled into the boy at class. This had been necessary even for his Transport Pilot's License, but, for his own satisfaction, Orvie had taken private instruction in some of the more advanced branches. His meteorological instruction, too, had been fairly complete, and even the most complicated plotted curves of isotherms, weather variations, wind currents, and the like were quite familiar. In short, Orvie was well on the way to becoming a thoroughly experienced pilot. But it had taken him three years' work.

Courtesy of U. S. Air Corps.

VOUGHT AIRPLANE AT NIGHT, SHOWING ILLUMINATION FOR TAKE-OFF.

Lieutenant J. R. Tate, Before Jump at Pearl Harbor, Honolulu.

Very few minutes after Orvie had taken the air, the big *Pipestone* roared clear over the Gulf of Mexico and the low-lying shores of Louisiana were left behind. The route of their great flight had been plotted with infinite accuracy, and the plotting map was stretched out before Major Lee. By the use of head-phones, both fliers were able to talk freely, despite the roar of the twin motors. No passengers had been taken, and, for this flight and the return, some of the seats had been taken out of the cabin and the vacant places filled with cans of gas.

Their plan was an ambitious one.

The Pan-American Mail is planned for a route via Cuba and Yucatan to a point near Vera Cruz, but Orvie and his father had decided to try a non-stop flight directly across the Gulf of Mexico to the City of Mexico, and, if everything held out, to shoot straight across the isthmus to the Pacific Ocean, drop an aerial message at Colima, circle around the semi-active volcano of Colima, and return to the Mexican capital.

If this could be done, it would be a record flight, and, above all, it would give the Mexicans a strong conviction of the powers of this great eight-passenger plane, for it would show that the *Pipestone* had enough power not only to make the trip, but 700 miles more into the bargain. Closely figured, this meant

nearly 1600 miles in the air. As the Sikorsky's economic flying speed was a trifle over 110 miles an hour, and as the weather reports were entirely favorable, this did not mean more than 15 or 16 hours' flying. It was less, then, than the Los Angeles to New York non-stop flight successfully accomplished in August, 1928, by Col. Goebel and H. J. Tucker; they took 18 hours, 58 minutes in a Lockhead-Vega.

Moreover, both Orvie and his father were trained pilots, and they could spell each other at the controls at four-hour intervals. Both were air navigators, too, so the work of plotting and calculation could go on continuously.

Owing to the great size and lifting power of the *Pipestone,* the carrying of food was no difficulty, and each pilot could eat as much as he pleased while the other was at the controls. There was no danger of fog or rain. No barometric depression was reported as being over the Pacific, and none could develop in a single day's flying.

The *Pipestone* had taken off a little after 3 A.M., with the advance grey of dawn in the June sky. The flight had been planned so that, should all go well, the fliers would be able to make their tour and still land in Mexico City by daylight. They had decided not to take the air-mail route via Merida, but to make

a straight line to Tampico, where, in case of need, a landing could be made.

"A good take-off, Orvie," said his father, when the last of the Mississippi delta-land was disappearing from view. "How is she running?"

"Perfectly! The engine turning seventeen, fifty; temperature a hundred and twenty. You can hear the motors!"

They were running superbly. In spite of the fact that they had already seen a good deal of usage, the two "Wasps" had not given a minute's trouble since the day that Orvie first took the machine to fly to flood rescue work. A good deal of the credit of this had to be given to Orvie, himself, for he was as particular and painstaking in his inspection and overhaul as in the old days when he first undertook a mechanic's work on the old *Dan'l Boone* at Lake Noocumpook.

For this flight, every possible preparation had been made, though it was not until the very day before the start that Major Lee and Orvie had divulged their plans to any one. That day, however, they had informed the head of the flying-field at New Orleans, and telegrams had been sent to the Aeronautics Division of the Chamber of Commerce, to the National Geographic Society, and to the President of the Lumber Corporation which had been the donor

of the plane, for Orvie always had taken the pains to keep the President informed of all his movements.

"This following wind," said the Major cheerfully, a little farther on, "is going to help us a lot."

"And we're going at a hundred and twelve an hour with three-quarters throttle," agreed Orvie. "That's a ground speed of nearly a hundred and thirty, isn't it?"

"About that."

A moment later:

"Here's a radio from Grosvenor of the National Geographic Society, wishing us good luck. It doesn't look as if we need to go eastward to Metamoros, does it?"

"Not a bit! Let's go on to Australia!"

The major smiled. Charles Kingford-Smith and Charles Ulm had done that, not very long before, flying from California to Australia in a Fokker plane, — a wonderful trip. But the boy's enthusiasm was infectious.

"What altitude are you keeping her at?" he asked.

"Just under two thousand. And not a cloud in the sky! Great!"

The plane roared on.

Shortly after 6 o'clock, Major Lee got out the thermos bottle of coffee and some ham-and-egg sand-

wiches and made a hearty breakfast. His hunger appeased, he changed places with Orvie and took the controls.

"Watch the chart and the log," he said. "We're running about S.E. half E. to allow for the drift. And eat hearty!"

"I'm ready for grub," the boy admitted. "Say, Father, this isn't like Arctic stuff, is it? It's just like a joy-ride."

"Wait till we get to the mountains, Son," came his father's warning.

"I've hopped the Alleghanies twice," said Orvie, with his mouth full.

Between nine and ten o'clock a blue line showed on the horizon. The Major was the first to see it.

"Mexico!" said he.

"And both motors running like a charm!"

Orvie swung his arms and let out a whoop of joy.

"We've done it, Dad; we've done it!"

"The first lap, anyway. Now, come and take the joy-stick. I've got to get the cameras ready."

This was the only branch of the work which, for some reason or other, Orvie did poorly. There's a knack in aerial photography, and the boy had never caught it.

The Mexican shore got nearer.

"We've allowed a bit too much for drift," said the Major, presently, "give her two points of southing, Orvie."

The course was changed.

Presently oil derricks appeared below them.

"This must be Tampico. Yes, that's it. Drop her a bit, now, Orvie."

"What altitude?"

"Two hundred, about."

"I can come lower if you like?"

"No, that's enough. . . . There, three plates ought to do. I'll drop the parachute message. . . . Let her climb again, Son, we don't want to waste gas, circling.

"Eh, what's that!" he cried sharply, as the plane gave an uneasy wobble. "Just a bump, I suppose."

"I was told," said Orvie, "the air's always bumpy when you come from sea to shore. I'll put her up a bit."

"Don't get too high; we want to follow the course of the Panuco River. If we get too far south, here, the mountains go climbing up. Orizaba gets to 18,000 feet."

"We could clear it!"

"We're not going to try any tricks," said his father. "Keep your eye on the compass and follow directions.

. . . How the river twists! Let's get a bit higher and airline it. . . . That's the idea."

They flew on.

"Now we're on the plateau. We break away from the river, here, and follow the railroad. Strike north, Son. Drop her a bit, I can't see the railroad line. . . . Yes, there it is. Through the low pass ahead. . . . That must be Zuniga. Straight east, now, for San Luis Potosi. We'll be there in half an hour."

"There is a town ahead!" said Orvie presently. "Doesn't it look grand? Good place for a landing-field."

"Down, Son. I'll take a few plates. . . . There we are! . . . Now, let me take the controls for a couple of hours. This is smooth sailing. How's the gas level?"

"We've got enough to go round Mexico a dozen times!"

"I hate exaggeration!" said the Major peevishly. "But we can do Colima, I think, easily. That wind astern, all across the Gulf, helped us a lot. Go and take some lunch."

But when they saw in the distance the range of the Sierra Madre Occidentale, Orvie resumed his piloting. It was only a little after 1 o'clock and they could have reached City of Mexico early in the

afternoon. But both were anxious to see the Pacific. They flew over Aguas Calientes and Guadalajara, following the railroad for 100 miles east of that city, and then bent southwards.

A dark line appeared.

"The Pacific!" cried Orvie. "Everything is coming our way!"

The Major said nothing, but he was not less pleased.

They ran far enough out to be actually flying over the Pacific, and then, following instructions, Orvie struck southward and followed the coast for about 75 miles.

"Strike inland now. . . . Ah, there's the volcano! She's smoking."

"Where? Oh!"

There was disappointment in the boy's voice.

"I suppose you expected to find it spouting fire like a blast-furnace!" exclaimed his father, amusedly. "You can't expect to do everything, Son! Photographing an active volcano is a piece of luck which, so far, has fallen to only one group of fliers."

"Who are they?"

"Army men at Honolulu. The vulcanologist at the great Hawaiian volcano of Kilauea asked for aerial photographs of the crater in eruption and the

flow of the lava streams. Two bombers and a Loening Amphibian were sent. They had a hard time taking the photographs, for the air was violently bumpy and the fumes were dangerous.

"But there was only one real adventure. One of the planes was flying low to photograph the moving lava, when it was noted that the stream suddenly separated and sent forth a rapidly flowing branch toward the sea. The photographer asked the pilot to follow, to see what happened.

"They saw! As that molten river struck the waters of the bay, it hurled a cloud of steam a thousand feet in air. The edge of the steam whirl caught the wing of the plane, or almost. A second later, and the plane would have been in the steam itself and both fliers scalded to death instantly. A steep bank and a shooting glide just saved them in the nick of time. But they circled and got splendid photos of that terrific steam-pillar, which rose without ceasing for forty-six hours in that battle between fire and sea."

There's nothing like that here!" said the boy. "Oh yes, there's a little stream of lava, isn't it? It certainly looks like lava."

"It is. Come; careful! Let's see how near we can get for a photo. . . . Look out!"

A swirl of heated air threw the plane to one side with a jolt.

Orvie straightened it instantly.

"There'd be no landing here, Father," he commented.

"No. But I want some plates. Don't circle. Get up and shoot down. I'll snap as we go past. Ready? Let her dive!"

The *Pipestone,* with a fairly steep dive added to her engine power at full throttle, plunged down at 150 or 160 miles an hour. The Major snapped the plates of both cameras, but, at that instant, he was hurled to the floor of the cabin.

The plane had side-slipped, and the air was a turmoil of eddies.

Well for Orvie that he had done some work in aerobatics!

The flat spin took a vicious spiral, but the boy, not losing his head, gently brought her toward a level keel, then nosed her down to a steep glide, almost parallel with the slope of the volcano. Below were trees.

But, before they got to them, the *Pipestone* was in control again and shooting off to safety.

"Wow!" said Orvie.

The Major made no comment.

The shave had been a close one.

Time was getting on. It was after four o'clock.

Flying past the volcano again — but keeping at a safe range from it — the Sikorsky climbed over the saw-tooth points of the Sierra Madre, and, under the Major's directions, found herself over the city of Guadalajara again. Thence it was but 300 miles to the City of Mexico.

"Have we enough gas?"

"None too much," said Orvie. "How's the wind?"

"Not much wind of any kind."

"We ought to make it. Take the controls, Father; that volcano business gave me a bit of a turn."

Orvie was a little pale. More, even, than his father, he realized how narrow had been their escape. But he soon was himself again, and, as they came over Mexico City in the early evening, he took the controls for landing. The plane alighted like a bird, and taxied to a hangar amid the enthusiastic shouts of the crowd which had gathered, enlightened by the telegraphic dispatches from Tampico, San Luis Potosi, Guadalajara, and Colima, to say nothing of cables from New Orleans.

There is no need to tell of the receptions given to the two aviators, but the greatest triumph of all came at the very end.

"Our purpose in flying to Mexico," said Major Lee

in a ringing speech, "was to have the honor of bringing back to America, as the first airplane passenger across the Gulf of Mexico, some citizen of this republic. Let the people of the City of Mexico choose. We can take four passengers and, if it seems fitting to you, we should like one of them to be a woman."

They cheered him to the echo.

"And," added Orvie, "I'd like one of them to be a boy!"

A week later, the *Pipestone* took the air in a perfect riot of shouting and siren-whistles. She had aboard one of the leading officials of the Mexican Air Force and his wife, a member of the Mexican Government, and a Mexican Boy Scout. Wind and weather were fair, and nine hours after leaving the Mexican capital, Orvie brought his plane down on the New Orleans landing-field.

"This," said the Mayor of New Orleans, as he welcomed them, "is a true Pan-American alliance. Our guests from the Republic of Mexico come to us, in a Canadian-given and American-built plane, with United States aviators. Long life to Pan-America!"

THE END

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